



OPINION – P.K. Balachandran

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Russian Collaboration is Best if Sri Lanka Goes for Nuclear Power Generation

The Sri Lanka Atomic Energy Authority (SLAEA) chairman, Prof. S.R.D. Rosa told *Daily Mirror* on December 12, 2023 that his office had given the nod to the incorporation of nuclear power in the country’s energy mix. This is in line with President Wickremesinghe’s exhortation last year that Sri Lankans should seriously think about nuclear power” to overcome the power shortage.

According to Prof. Rosa, the search is on for a foreign development partner. He has said that proposals have been received from Russia, US, Denmark and China to set up a SMR that would cost about US\$ 2 billion. Delegations from Russia and China have already met the SLAEA. But Russia appears to be the preferred partner and rightly so. Russia dominates the European market for nuclear energy, even amid its war against Ukraine and US and European sanctions against it.

The safety of nuclear power generation and its economic advantages have been discussed threadbare in a 2018 work by Mahesh N. Jayakody and Jeysingam Jeyasugiththan of Colombo University and Prasad Mahakumara of the government of Sri Lanka. Their study noted that while the installation cost of nuclear plants would be

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high and disposing of nuclear waste would be challenging, nuclear plants are marked by low maintenance costs and a minimum adverse environmental impact.

In the long run, nuclear energy would work out to be cheaper, the authors said, while recommending the Russian VVER-1000 and the American AP-1000 models based on PWR. A US Office of Nuclear Energy report of 2021 said that nuclear plants have the highest ‘capacity factor’ (maximum capacity) compared to any other energy source. Nuclear plants are

producing maximum power more than 92% of the time during the year. That's about nearly two times more than natural gas and coal units, and are almost three times or more reliable than wind and solar plants."

According to the US Office of Nuclear Energy, nuclear power plants require less maintenance and are designed to operate for longer stretches before refuelling (typically every 1.5 or 2 years). As regards

the raw materials the US office said: Uranium and thorium are both more abundant than tin; and with the new generation of fast-breeder and thorium reactors, we would have abundant nuclear energy for millions of years. Yet, even if the resources lasted a mere 1,000 years, we would have ample time to develop exotic new future energy sources."

On safety, which is a major concern in Sri Lanka, the Sri Lankan researchers cited above maintain that the evolution of nuclear power plant technologies has made reactors very safe and protected from human error. According to Physics

World nuclear power is hundreds of times" safer than coal, gas, and oil. On the danger from nuclear waste, the website www.world-nuclear.org says: "The amount of waste generated by nuclear power is very small relative to other thermal electricity generation technologies; nuclear waste is neither particularly hazardous nor hard to manage relative to other toxic industrial waste."

Why Russia is the Best Option: Kristyna Foltynova of Radio Free Europe says that European nations are unable to stop the import of Russian nuclear material even in the midst of the war in Ukraine because Russia dominates the world market in nuclear material. Russia is among the five countries with the world's largest uranium resources. But uranium mining is just one step in the nuclear process. Raw uranium needs to be refined into uranium concentrate, converted into

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gas, and then enriched. And this is where Russia excels, Foltynova says. In 2020, there were just four conversion plants operating commercially — in Canada, China, France, and Russia. Russia was

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The same goes for uranium enrichment, the next step in the nuclear cycle. According to 2018 data, Russia once again was responsible for the largest share — about 46%", the Radio Free Europe researcher said. According to the latest available data, the European Union purchased about 20% of its natural uranium and 26 % of its enrichment services from Russia in 2020. The US imported about 14% of its uranium and 28% of all enrichment services from Russia in 2021," Foltynova stated. Nuclear reactors made in Russia are known as VVER. According to Foltynova, there are 11 countries where various types of VVERs are operating currently.

Nuclear Plant Development: Russia is considered the world leader in the export of nuclear plants. According to Foltynova, between 2012 and 2021, the Russian nuclear company, Rosatom,

initiated the construction of 19 nuclear reactors; 15 of these were abroad. That is far more than the next most prolific providers: China, France, and South Korea. Currently, there are 11 countries where various types of VVERs are operating, including Bulgaria, the Czech Republic, Hungary, and Finland. On top of that, other countries such as Egypt, Turkey, and Argentina currently have these reactors under construction or plan to build them.

To keep the reactors operating, plants need a regular supply of nuclear fuel and this is where there is an acute dependence on Russia. Although

there are several suppliers the market, the Russian TVEL Fuel Company is currently the only authorized supplier of fuel needed for VVER-440s," Foltynova points out. Russia is also able to supply High-Assay Low-Enriched Uranium (HALEU), which is a type of fuel that will be needed for more advanced reactors that are now under development by many companies in the US. According to the American Office of Nuclear Energy, HALEU availability in the US is limited. At the moment, the only supplier able to provide the fuel on a commercial scale is Russia's Tenex (owned by Rosatom), Foltynova says.

Russia is expanding Its Market: Selling nuclear technology is also part of Russia's foreign policy, especially now, when Western countries are trying to isolate it by boycotts and sanctions. And Russia is succeeding in this venture. One of the reasons countries want to cooperate with Russia (defying sanctions) is that it offers a package solution". Russia will not only build a nuclear plant and supply fuel, but it also trains local specialists, helps with safety questions, runs scholarship programs, and disposes of radioactive waste," Foltynova points out. Sri Lanka has been offered such assistance according to Prof Rosa.

Russia also offers attractive loans, which are backed by government subsidies and cover at least 80% of construction costs. Russia has already lent US\$ 10 billion to Hungary, US\$ 11 billion to Bangladesh and US\$ 25 billion to Egypt to build nuclear power plants," Foltynova adds. Russia is operating nuclear reactors in 11 countries, and more are under construction or being planned. Besides that, Russia has also signed either MOUs with at least 30 countries, mostly in Africa. According to Bloomberg, Russia's nuclear fuel and technology sales abroad rose more than 20% in 2022, according to data compiled by the UK's Royal United Services Institute. Purchases by EU countries rose to the highest point in three years.

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The figures show NATO members including Bulgaria, the Czech Republic, Hungary and Slovakia continued to purchase Rosatom fuel last year, amid Ukrainian pleas to shut down the trade after Russia hijacked Europe's biggest power plant, Bloomberg said. Importantly, Rosatom provides about one-fifth of the enriched uranium needed for the 92 reactors in the US. In Europe, utilities that generate power for 100 million people rely on the company.

Source: <https://www.lankaweb.com/news/items/2023/12/25/russian-collaboration-is-best-if-sri-lanka-goes-for-nuclear-power-generation/>, 25 December 2023.

OPINION – Sonny Lo Shiu Hing

Military Deterrence, Muscle-Flexing and Crisis in the Korean Peninsula

The military situation in the Korean peninsula has suddenly deteriorated after a series of remarks made by the North Korean and South Korean leaders and a range of military exercises from the South Korean and the US, followed by North Korean artillery action. Military deterrence on both sides of the Korean peninsula has led to real military muscle-flexing, plunging the relations between North Korea and South Korea into an unprecedented military crisis five years after the September 2018 inter-Korean summit when both sides were committed to achieving a Korean peninsula free from nuclear weapons.

The current crisis could be trace back to a series of remarks made by the political leaders of both North Korea and South Korea, followed by military exercises and actions – an ominous sign that may bring about either military accidents or conflicts in 2024.

On January 1, 2024, South Korean president Yeo remarked that South Korea and the US would finish strengthening a defence position that would

“completely block” the North Korean missile threat, and that the Seoul-Washington alliance will achieve “genuine and permanent peace” based on military strength. In July 2023, both friendly capitalistic countries formed a Nuclear Consultative Group with the US commitment to protecting South Korea with a nuclear arsenal. This group held its second meeting on December 16, after which a statement was released by the US saying that Washington would have a swift and decisive response if there is any North Korean attack against South Korea.

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Military relations between South and North Korea became challenging in 2023, when Pyongyang stepped up its military armament and as Kim Jong Un visited Russia and expressed his appreciation with the Russian advanced military weaponry. At the same time, North Korea and South Korea have enhanced their military surveillance along the border.

In November 2023, North Korea fired its first spy satellite into the orbit, providing the necessary glimpse of South Korea’s military capabilities, sites, and targets. South Korea remarked that such a satellite launch violated a UNSC resolution prohibiting Pyongyang to utilize ballistic missile technology. By December 2023, the Korean Central News Agency reported that North Korea would strengthen the spy satellite programs by having three additional satellites in 2024. Furthermore, it would consolidate its nuclear arsenal and military drones. The military race over space would aim at giving North Korea an edge over South Korea – a move that explained why South Korea and the US had to respond by strengthening their nuclear weapon cooperation.

What was alarming about Kim’s speech was that he mentioned the need for “militant tasks for the People’s Army and he munitions industry, nuclear weapons and civil defence sectors to further accelerate the war preparations.” Kim’s speech was an important one as he pointed to the danger of an armed confrontation in the Korean peninsula as a “fast” phenomenon “becoming a reality.

The entire year of 2023 witnessed the continuous military push from North Korea, which launched inter-continental ballistic missiles tests, like the long-range and solid-fuelled Hwasong-18 missile, and which deployed more military weapons, including a nuclear missile submarine, aircraft carriers and large air bombers.

Kim Jong-Un delivered an important speech on December 27, 2023 during the 8th Central Committee meeting of the Workers’ Party, saying that both North Korea and North Korea are reaching the stage of becoming hostile countries, and that North

Korea’s nuclear war “deterrent” would not hesitate to take action if Seoul and Wahington adopt a military confrontation with Pyongyang – an important remark pointing to Kim’s tendency to change from military “deterrence” to a concrete action of flexing its military muscle further if South Korea and the US were to conduct military exercises.

Kim remarked that the South Korean and US side regarded North Korea as “the main enemy,” that both countries sought to promote regime “collapse” of Pyongyang, and that they tried to unify the north through a process of

“absorption.” In response to the Washington-Seoul alliance, Kim added that Pyongyang would expand its strategic cooperation with “anti-imperialist independent” countries, implying Russia which has been provided with North Korean weapons in its Ukrainian war.

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of an armed confrontation in the Korean peninsula as a “fast” phenomenon “becoming a reality.” His comment was made in response to the escalated protective actions from both South Korea and the US – a strengthened cooperative attempt that made Kim to mention the North Korean necessity of “sharpening the treasured sword” to protect itself.

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His speech content was released by the North Korean side on January 1, 2024, to time in the North Korean military artillery reactions on January 5 to the military exercise between South Korea and US scheduled to be held for a week starting from December 29, 2023. The rhetorical escalation of Kim was matched by a corresponding phenomenon from his South Korean counterpart, President Yoon, who on December 28 “urge you to immediately and firmly crush the enemy’s will for a provocation on the spot.” Even though North Korea has been suffering from food shortage even after the end of Covid-19 and its variants, its military-first policy has remained unchanged, and its militarization efforts were maximized and accelerated throughout 2023.

While Kim and his think tank and military generals perceived the North Korean militarization as an effective “deterrent” against the alliance formed by the US and South Korea, the Washington-Seoul side have been determined to consolidate their “deterrence” against the North Korean threat. Mutual perceptions of military threats have therefore propelled both sides to flex their military muscles. On December 29, 2023, South Korea and the US began a week-long firing drill near the North Korean border. The South Korean side said that the joint military exercise aimed at testing and enhancing military combat readiness simulating any enemy

Mutual perceptions of military threats have therefore propelled both sides to flex their military muscles. On December 29, 2023, South Korea and the US began a week-long firing drill near the North Korean border. The South Korean side said that the joint military exercise aimed at testing and enhancing military combat readiness simulating any enemy aggression.

aggression. The joint military exercise involved 110 large combat weapons, including the South Korean tanks, anti-aircraft artillery, US aircrafts and armoured vehicles. The South Korean navy was also involved, embracing anti-submarine manoeuvres in the waters in the east, west and the south, and mobilizing destroyers, frigates, and corvettes. South Korea and the US also

increased the scope and intensity of their joint military exercises in 2023 as a response to the escalating military preparations on the Pyongyang side. In other words, every escalated military preparation from each of the two sides – North Korea on the one hand and South Korea and US on the other hand – triggered kneejerk reaction from the other side, thereby escalating military tensions further and cyclically.

On the morning of January 5, 2024, North Korea fired two hundred rounds of artillery into the waters near the western sea border with South Korea, especially the South Korean islands, namely Baengnyeong and Yeonpyeong islands. In response, the South Korean government appealed to the residents in the islands to hide in their shelters. Baengnyeong island has 5,000 residents and Yeonpyeong has 2,000 citizens. In 2010, the North Korean artillery fire reached the island of Yeonpyeong, killing two marines and two civilians, injuring fifteen other soldiers and two civilians. At that time, the North Korean side put the blame on the South Korean side, saying that the attack

was a response to a South Korean artillery drill in the waters near Yeonpyeong. The artillery on the morning of January 5, 2024 fell north of the northern limit line, which was a disputed border drawn up by the UN by the end of the Korean war in 1953. The North Korean artillery fire and its reach matched Kim’s remarks as implying that

both North Korea and South Korea are approaching the stage of becoming belligerent states. South Korea's Joint Chiefs of Staff said the North Korean artillery fire was a provocative act that "threatens peace and heighten tensions on the Korean peninsula."

In response, the South Korean military held its maritime shooting exercise on the afternoon of Friday, illustrating its kneejerk reaction cyclically. However, such a cycle of military responses from both sides would lead to tremendous dangers of triggering any military accidents and even conflicts in the year 2024. ...With both sides holding firm militarily, a military crisis has already emerged with the possibility of leading to accidents or conflicts. If both sides back down, the situation would return to the status quo and stability. If either side backs down, the other side is seen as being a dominant and victorious military player – not a good sign leading to the status quo.

Kim's speech on December 27, which was reported by the Korean Central News Agency on December 31, had interesting ideas that implicitly pointed to the possibility of dialogue between North Korea and South Korea in the future. For the first time in his speech, Kim mentioned that the two Korean sides would not be able to reunite and that both sides are no longer the same nation. However, he said that the South Korean side insists on one system unification based on "absorption" and "system." What he implied significantly is that unless both North Korea and South Korea adopt a system of two systems – two different political, social, economic, and military systems – they would not be able to reunite.

Kim also remarked that North Korea insists on unification based on "one nation, one country and two systems." If so, what he meant is that North Korea and South Korea would have the chance of discussing unification based on "one Korean

nation, one country (name unclear and up to negotiations) and two different systems." If this interpretation above is accurate, Kim alludes to the possibility of using a special Korean version of "one country, one nation, two systems" to deal with the political future of two Koreas. The idea of using "one country, two systems" to discuss the future of the two Korean sides is not new as the South Korean authorities in the past did toy with this idea (at one time it was reported that a few officials were sent to Hong Kong to study the concept and implementation of "one country, two systems"), but Kim this time adds the concept of "one nation."

Eventually, both the South Korean and North Korean sides, if their relations become more stable and cordial, should explore this innovative and potentially breakthrough formula of "one country, one nation and two systems" so that reunification of the two Koreas would become a realistic possibility. The current crisis in the Korean peninsula also presents the opportunities for calmness and dialogue, if both sides consider the question of

peace as an urgent priority. Both sides need to scale down their military activities in response to the other side. Otherwise, military accidents and/or conflicts may suddenly erupt.

In conclusion, the rhetorical escalations of Kim Jong Un and Yoon Suk Yeol have matched the increase in flexing the military muscles of both North Korea and South Korea, respectively. The current situation is entering a crisis in which both sides must defuse. The hardline stance of North Korea may have an unintended consequence of shaping the presidential election result of South Korea in 2027, especially at a time when Yoon's popularity and his ruling People Power Party will be put to a vote by the South Koreans. From now to 2027, however, there is a realistic danger of escalating muscle-flexing activities into a real military conflict. Both sides have already hardened

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their position verbally and militarily. Deterrence from both sides have led to increases in military muscle-flexing, which is now plunging the Korean peninsula into a crisis of military management.

Source: <https://www.macaubusiness.com/opinion-military-deterrence-muscle-flexing-and-crisis-in-the-korean-peninsula/>, 26 December 2023.

OPINION – Louis Beres

Doomsday: What Could Drive Israel and Iran to Start Launching Nuclear Weapons?

Although Israel's Gaza war is most visibly being waged against Hamas, the ultimate adversary is Iran. If Israel's counter-terrorism efforts should sometime bring it into direct confrontation with Iran, the result could be an immediate escalation between these two adversary states. In such a plausible scenario, even a still-pre-nuclear Iran could elicit a "limited" Israeli nuclear reprisal. The principal escalation dangers would be an Iranian use of radiation dispersal weapons or an Iranian rocket attack on Israel's Dimona nuclear reactor.

For Israel, a country smaller than Lake Michigan, nuclear weapons and strategy remain essential to national survival. Israel's traditional policy of deliberate nuclear ambiguity, or "the bomb in the basement," goes back to its early days. During the 1950s, Prime Minister Ben-Gurion understood the need for a dramatic "equalizer" against larger and more populous regional enemies. Today, facing a recalcitrant and soon-to-be nuclear Iran, Israel needs to update and refine its policy of deliberate nuclear ambiguity. The key objective of such needed

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Unless Jerusalem were to consider Pakistan an authentic enemy, Israel presently has no already-nuclear enemies. Still, as an unstable Islamic state, Pakistan is potentially subject to a coup d'état by assorted Jihadist elements and is closely aligned with Saudi Arabia. The Sunni Saudi kingdom could sometime decide to "go nuclear" itself because of Shiite Iran's steadily accelerating nuclear progress.

changes would be credible nuclear deterrence, a goal that will now require selective nuclear disclosure. Though ironic and counter-intuitive, Iran will need to be convinced that Israel's nuclear arms are not too destructive for actual use.

There will be perplexing nuances. For Israel to fashion reason-based nuclear policies, Iran should be considered rational. But it is conceivable that Iran might act irrationally, perhaps even in alliance with other states (such as Syria or North Korea) or kindred terror groups (such as Hamas, Hezbollah, Palestinian Islamic Jihad or the Houthis). Unless Jerusalem were to consider Pakistan an authentic enemy, Israel presently has no already-nuclear enemies. Still, as an unstable Islamic state, Pakistan is potentially subject to a coup d'état by assorted Jihadist elements and is closely aligned with Saudi Arabia. The Sunni Saudi kingdom could sometime decide to "go nuclear" itself because of Shiite Iran's steadily accelerating nuclear progress.

For Israel's nuclear deterrence to work longer-term, Iran will need to be told more rather than less about Israel's nuclear targeting doctrine and the invulnerability of Israel's nuclear forces. In concert with such changes, Jerusalem will need to

clarify its still-opaque "Samson Option." The point would not be to "die with the Philistines" (per the biblical Book of Judges), but to enhance "high destruction" options of its nuclear deterrence posture. Though the only gainful purpose of Israel's nuclear weapons should be deterrence at different levels of military destructiveness, there will remain circumstances under which Israeli nuclear deterrence could fail. How might such intolerable circumstances arise?

Four distinct scenarios emerge, with results that range from very destructive to catastrophic. First, if Iran were to launch “only” a massive conventional attack on Israel, Jerusalem could respond with a limited nuclear retaliation. If Iranian first-strikes were to involve chemical or biological weapons, Israel might also decide to launch a measured nuclear reprisal. This decision would depend, in large part, on Jerusalem’s expectations concerning follow-on Iranian attacks and its calculations of comparative damage-limitation. A nuclear retaliation by Israel could be ruled out conclusively only in circumstances where the Iranian aggression is entirely conventional and “hard-target” oriented — that is, oriented toward Israeli weapons and military infrastructures, not toward Israel’s civilian populations.

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A second scenario would involve Israel feeling compelled to preempt Iranian aggression with conventional weapons. In that case, that enemy state’s response would largely determine Israel’s next moves. If this response were in any way nuclear, including “mere” radiological weapons, Israel would likely turn to certain controlled forms of nuclear counter-retaliation. If Iran’s retaliation were to involve other non-nuclear weapons of mass destruction, Israel could still feel pressed to take the escalatory initiative. This decision would depend upon Jerusalem’s considered judgment of enemy intent and on its corollary calculations of damage-limitation.

An Israeli nuclear preemption could reasonably be expected only if Iran had already acquired nuclear or other weapons of mass destruction, threatened to use them, began a countdown to launch, and Jerusalem believed that exclusively conventional preemption could not save the Jewish State from destruction.

If the Iranian response to Israel’s preemption were limited to hard-target conventional strikes, it is unlikely that Israel’s decision-makers would go nuclear. If, however, the Iranian conventional retaliation was “all-out” and directed in part toward Israeli civilian populations, an Israeli

nuclear counter-retaliation could not be excluded. Such a counter-retaliation could be ruled out only if Iran’s conventional retaliation were proportionate to Israel’s preemption; confined to Israeli military targets; circumscribed by legal limits of “proportionality” and “military necessity,” and accompanied by verifiable assurances of non-escalatory intent.

A third (and highly unlikely) scenario involves Israel launching a preemptive nuclear strike against Iran. Although circumstances could arise wherein such a strike would be rational and permissible under international law, it is improbable that Israel would allow itself to reach such end-of-the-line circumstances. An Israeli nuclear preemption could reasonably be expected only if Iran had already acquired nuclear or other weapons of mass destruction, threatened to use

them, began a countdown to launch, and Jerusalem believed that exclusively conventional preemption could not save the Jewish State from destruction.

A fourth scenario would be that of nuclear war fighting. This could occur if an Iranian nuclear first-strike or retaliation for an Israeli

conventional first strike failed to destroy Israel’s second-strike nuclear capability, or vice versa. For the time being, of course, any Iranian nuclear capacity would be limited to radiation dispersal weapons.

Source: <https://thehill.com/opinion/international/4385217-what-could-drive-israel-and-iran-to-start-launching-the-nukes/>, 04 January 2024.

OPINION – M Ramesh

This New Nuclear Fuel Can Guarantee India’s Green Energy Transition

An invention by an American company, set up by a person of Indian origin, is making waves in the

nuclear establishment of North America. If adopted in India, it can guarantee green energy security for the subcontinent by fasttracking the use of Thorium in nuclear reactors. India has the world's largest reserves of Thorium, estimated at 1.07 million tonnes, enough to last over a century. If India uses this Thorium, it can then produce enough green energy and easily turn netzero by its target date of 2070.

Clean Core's nuclear fuel bundle made from Thorium and HALEU calls this concoction ANEEL (Advanced Nuclear Energy for Enriched Life) — named so to honour one of India's foremost nuclear scientists, Dr Anil Kakodkar. ANEEL can be used in the existing PHWRs, an indigenous reactor system that is the workhorse of India's nuclear fleet.

However, Thorium is a fertile material and not a fissile material. This means, it must be paired with Uranium235 or Plutonium239 to be used as fuel in a reactor. As neutrons from these fissile materials bombard Thorium, it mutates into Uranium233, which is also a fissile material. So, to use the Thorium in India, you need sufficient stocks of Uranium235 (which India has very little of), or Plutonium239 (which is produced using Uranium235). So, the question has been, how to use Thorium with minimal use of (precious) Uranium.

This is where the invention of Mehul Shah, Founder and CEO of Clean Core Thorium Energy, comes in.

The Chicago based company has developed (and patented) a fuel, which is a mix of Thorium and Uranium of a certain level of enrichment, called HALEU (High Assay Low Enriched Uranium).

Clean Core: Clean Core's nuclear fuel bundle made from Thorium and HALEU calls this concoction ANEEL (Advanced Nuclear Energy for Enriched Life) — named so to honour one of India's foremost nuclear scientists, Dr Anil Kakodkar. ANEEL can be used in the existing PHWRs, an indigenous reactor system that is the workhorse of India's nuclear fleet. India has 18 PHWR reactors of a total capacity of 4,460 MW and is building ten more of

700 MW each. If pursued, Clean Core's ANEEL fuel can prove to be a gamechanger for India.

According to the World Nuclear Association, most of the current reactors run on uranium fuel enriched up to 5 per cent Uranium235. HALEU is Uranium enriched to more than 5 per cent but less than 20 per cent.

It is needed for many of the advanced nuclear reactor designs under

development. "HALEU is not yet widely available commercially. At present only Russia and China have the infrastructure to produce HALEU at scale. Centrus Energy, in the US, began producing HALEU from a demonstration scale cascade in October 2023," says the Association. With uncertain

commercialisation timelines, HALEU suppliers have remained cautious on scaling capacity due to demand side risk.

However, with Clean Core's nearterm timeline to commercialisation, the company can help strengthen the demand side confidence for HALEU suppliers. India's approach to Thorium utilisation has been to make a Thorium

blanket around uranium or plutonium reactors, so that as the reactor produces energy, it also converts thorium into uranium233. However, ANEEL provides an easier and quicker alternative for the deployment of thorium leveraging imported HALEU.

Nuclear Waste Reduction: Furthermore, in utilising this fuel, reactor operators can enjoy a dramatic reduction in nuclear waste volume and operating costs. Another significant advantage is the inherent operating characteristics of the ANEEL fuel bundle — it lasts much longer and

burns more efficiently. Its burnup is 60,000 MWdays per tonne, compared with the 7,000 MW days per tonne of the conventional natural uranium fuel in PHWRs. This higher burnup significantly impacts the waste volumes and economics of reactor operations compared with the currently used natural uranium.

For example, in an existing Indian 220 MW PHWR, while using natural uranium fuel, an average of eight bundles would need to be replaced daily for the rest of the reactor's operating life of 60 years. That is about 1,75,000 bundles used over the life of a reactor. With the ANEEL fuel, an average of only one such bundle would need to be replaced daily resulting in about 22,000 bundles used over the lifetime of the reactor. This leads to significant reduction in waste generation and cost savings.

Due to the inherent benefits of using thorium, the spent ANEEL fuel cannot be used for weapons — a source of comfort for foreign uranium suppliers and reactor operators, says Mehul Shah. With all these benefits, Shah believes that ANEEL powered. With all these benefits, Shah believes that ANEEL powered 220 MW Indian PHWR can fill a growing need for clean, baseload energy production, as highlighted by the pledge to triple nuclear capacity by more than 20 countries at the recently held COP28.

Other countries are also showing interest in using ANEEL. ...In April 2023, Canadian Nuclear Laboratories signed a MoU with Clean Core "to further the development and deployment of Clean Core's ANEEL fuel," according to a press release. Under the MoU, CNL would support Clean Core's activities, including R&D and licensing.

Source: <https://www.pressreader.com/india/businessline-chennai-9WVV/20240108/281852943405634>, 10 January 2024.

OPINION – Kazi Anwarul Masud

Is It Conceivable for Russia to Use Nuclear Weapons?

Such a move would not only end mankind as we know it, but would also mean the end of Russia itself. One would like to answer in the negative given the fact that such a move would not only end mankind as we know it, but would also mean the end of Russia itself. There is no reason to believe that the world, regardless of the number of nuclear weapons they possess, would let a madman survive. Yet Putin's remarks, are often misrepresented by learned people whose writings are printed in respected magazines like Foreign Affairs and other publications as well, perhaps on the ground that freedom of expression is guaranteed by democracies throughout the world. ...

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US Policy on Russian Use of Nuclear Weapons:

The writer quoted at length President Biden in the following words: "I worry about Putin using tactical

nuclear weapons," President Biden said in June. The risk, he continued, is "real." However, officials do not appear to believe that the war in Ukraine could lead Russia to use its nuclear arsenal against a NATO state, however furious it is at the West for supporting Ukraine. That is a mistake. US officials have it backward. It is quite unlikely that Putin will use a nuclear weapon on the battlefield in Ukraine, but he may move toward using one against NATO. Unlike the West, Putin may not fear a nuclear standoff: he is well versed in Russia's nuclear arsenal and the tenets of nuclear deterrence, and possibly sees himself as uniquely suited to navigating a nuclear crisis.

Russian President on Use of Nuclear Weapons:

Vladimir Putin has been remarkably consistent that Russia is willing to use nuclear weapons against NATO to defend its interests in Ukraine. Peter Schroeder added that even eight years ago, in a

television interview done a year after Russia invaded Crimea, Putin declared that he had been ready to place Russian nuclear forces on alert to prevent Western forces from interfering in Moscow's takeover of the peninsula. Russian nuclear weapons use is not imminent. But if Putin does escalate the war, for instance by attacking NATO with conventional weapons, he will likely move very swiftly, so as not to give the US a chance to maneuver away from a crisis. Washington will struggle to deter a Kremlin so emboldened.

Invasion of Ukraine and Russian Nuclear Policy:

Ukraine is too central to the Kremlin's ambitions—and too secondary to the United States—for Putin to believe any American threats. Ultimately, Putin will expect the United States to back down before fighting a nuclear conflict over land so far from home. Do people believe that such an eventuality can happen in a world that has become so complex and so interdependent with phrases like "de-risking" and "de-globalization" and many other phrases being taught in schools from primary levels.

Russian Suspension of New Start Treaty: In his long article Peter Schroeder wrote that in February 2023, Russia suspended participation in the New START treaty, which regulated how many nuclear weapons Moscow and Washington could have. In March, the Kremlin announced that it would move some of its nuclear weapons into Belarus. In October of that year, Putin suggested that Russia might restart nuclear testing. All the while, Russian government officials have threatened to launch a nuclear attack, as former President Dmitriy Medvedev did in July when he said Russia could "use nuclear weapons" to conclude the Ukraine

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Russian government officials have threatened to launch a nuclear attack, as former President Dmitriy Medvedev did in July when he said Russia could "use nuclear weapons" to conclude the Ukraine war in a few days. US officials, of course, have paid attention to these threats, but they have not been convinced by them. They imagined that Moscow may use small so-called tactical nuclear weapons on the battlefield, but not large so-called strategic ones against NATO states.

war in a few days. US officials, of course, have paid attention to these threats, but they have not been convinced by them. They imagined that Moscow may use small so-called tactical nuclear weapons on the battlefield, but not large so-called strategic ones against NATO states.

The US is Hopeful that Russia will not Use Nuclear Weapons:

According to National Security Advisor, Jake Sullivan US experts in recent days thought that there was little fear that Russia would use strategic nuclear weapons in Ukraine or against the West, but some remained concerned that Russia could use tactical weapons. Putin, their thinking went might use these weapons to help Russian forces halt a Ukrainian attack that appeared on the verge of taking back Crimea or inflicting a significant defeat that threatened to push Russian forces out of eastern Ukraine.

However, the growing complacency among US officials is based on a misunderstanding of Putin's rhetoric and the dynamics that keep Moscow from using nuclear weapons. When Putin invokes his arsenal, he is not trying to warn that Russia

could use tactical nuclear weapons in Ukraine. Rather, his rhetoric is designed to threaten NATO itself. It is a blinking red light, a warning to American decision-makers that Moscow is willing to create a nuclear confrontation with Washington if needed to win in Ukraine. So long as Putin remains optimistic about Russia's odds, he is unlikely to rock the boat in Ukraine. Tactical nuclear weapons would do little to help Russia break the stalemate. Ukrainian forces are well entrenched along a frontline that extends for roughly 600 miles, and so even dozens of tactical weapons would not be enough to let Russia push

through. Even if they were, Russia does not have the maneuverable reserve forces needed to exploit any opening created by these weapons.

Chatham House Weighs in on Russian Nuclear Policy:

Peter Schroeder's thesis was countered by Valeria Akimenko, Senior Research Analyst, Conflict Studies Research Centre of Chatham House explaining the myth of the use of Russian nuclear weapons and wrote that the circumstances under which Russia might use nuclear weapons have been the subject of lengthy and heated debate. This is in part because of mixed messages from Russia itself. Published nuclear doctrine describes a very limited set of circumstances predicting a nuclear response by Russia. But this is at odds with consistent public rhetoric from President Vladimir Putin down through the entire information apparatus of the Russian state, which has frequently made both implicit and explicit Russia's nuclear rhetoric being incessant and emphasized readiness to use these weapons. But it aims to extract the maximum possible practical value from their mere possession, with or without actual intent to use.

The impact of these threats builds on an intensive and highly effective program by Russia's extended network

of influencers abroad promising almost inevitable escalation to nuclear war if Russia's plans are opposed. While the constant Russian nuclear refrain suggests a greater willingness to consider nuclear use in real life, in turn, based on Russia's demonstrated greater willingness to inflict mass destruction and mass casualties in pursuit of its aims, the rationale behind these threats is to

While the constant Russian nuclear refrain suggests a greater willingness to consider nuclear use in real life, in turn, based on Russia's demonstrated greater willingness to inflict mass destruction and mass casualties in pursuit of its aims, the rationale behind these threats is to increase Russia's operational latitude without actually having to go to war, by undermining Western will to resist.

increase Russia's operational latitude without actually having to go to war, by undermining Western will to resist. This campaign has been effective in creating an impression that Russia has an exceptionally low threshold for nuclear use and that a wide range of circumstances or "provocations" could cause that threshold to be crossed.

Russian Military Doctrine Provides First Use of

Nuclear Weapons in Conventional War: Russian nuclear doctrine provides for nuclear first use in a conventional war when the country's "very existence" is at risk. But this has not prevented a wide range of risks in any war, even one started by Russia, being described as existential. It is argued that there need not even be a war. International sanctions and even "aggressive" statements by Russia's "enemies" have repeatedly proved sufficient to trigger renewed

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nuclear threats. Western political leaders have themselves confirmed that Russia has succeeded in shaping their behavior through nuclear intimidation. A wide range of experienced analysts outside Russia hold the opinion that Russia's nuclear weapons would only actually be used *in extremis*. This view holds that Russia's nuclear arms are a political, defensive

deterrent, and thus unlikely to be employed. It further suggests that advances in Russia's conventional capabilities have made it less likely to need to resort to the use of nuclear weapons.

The debate is further complicated by the layering of Russia's nuclear capabilities, from non-strategic to strategic weapons. The contributions of

Russian commentators on the nuclear policy should be treated with skepticism, but in many cases, they too have played down the likelihood of nuclear use. The arms control specialist Nikolai Sokov holds that Russia's nuclear doctrine is defensive and that it reserves nuclear use "exclusively for situations when Russia is attacked," albeit in a broader range of circumstances than the widely recognized criterion of an attack "which threatens the existence of the state itself."

Russia also continues to upgrade its nuclear command and control systems, regarded as a vital second-strike and warfighting capability. Moreover, while Russia's nuclear doctrine posits its nuclear weapons as 'exclusively' a deterrent, it also sets out specific criteria for their employment.

Limited Nuclear War is "Alien" to Russian Strategy: Meanwhile, the former Russian military intelligence officer and Carnegie Moscow analyst Dmitri Trenin has argued that the notion of a limited nuclear war has always been "alien" to Russian strategy. Informed analysts outside Russia have also noted a trend for the threshold for Russian nuclear use to become higher, not lower, as Moscow's conventional military capabilities have improved from their nadir in the 2000s. Kristin Ven Bruusgaard observed that "Russia today is less, not more likely to use nuclear weapons than it was 10 or 15 years ago." Olga Oliker has also argued there is little evidence Russia has lowered its threshold for nuclear use. Disagreements over the precise threshold for Russia to use nuclear weapons risk obscuring the key point that that threshold is far lower than for Western nuclear powers. The moral dimension of nuclear use is also far less of a constraint for Russia than for democracies, as is also the case with other actions in Russia's conduct of war that cause revulsion abroad – most recently highlighted in Ukraine. Russia also continues to upgrade its nuclear command and control systems, regarded as a vital second-strike and warfighting capability.

The risks of miscalculation, meanwhile, have been strongly emphasized by Russia in its campaign of intimidation but do nevertheless exist. However, while all of these factors demonstrate that Russia's attitude to nuclear use is significantly different from that of a NATO nuclear power, this attitude does not set preconditions for reckless, pointless or suicidal nuclear attacks in response to marginal threats.

Moreover, while Russia's nuclear doctrine posits its nuclear weapons as 'exclusively' a deterrent, it also sets out specific criteria for their employment. Each of these criteria allows for nuclear first use in circumstances that no Western leader "would even consider."

Russia Shifts to Policy of First Use Nuclear Weapons:

Russia's shifting first-use posture in the late 1990s and into the 2000s — a pivot from "no first use" to "first use if necessary" to "assured first use if Russia's survival is at stake" —

demonstrates its reliance on a nuclear arsenal for both deterrent and warfighting purposes. The risks of miscalculation, meanwhile, have been strongly emphasized by Russia in its campaign of intimidation but do nevertheless exist. However, while all of these factors demonstrate that Russia's attitude to nuclear use is significantly different from that of a NATO nuclear power, this attitude does not set preconditions for reckless, pointless or suicidal nuclear attacks in response to marginal threats. While Russia's attitude to nuclear use is significantly different from that of a NATO nuclear power, this attitude does not set preconditions for reckless, pointless or suicidal nuclear attacks in response to marginal threats.

As noted above, the most direct and obvious success of Russia's nuclear threats

is in constraining Western support for Ukraine. But Russia capitalizes far more broadly on the perception that it must not be impeded, offended or, most of all, defeated. This means there are few credible options for responding in the event of Russian use of non-strategic nuclear weapons (NSNWs), which in turn enhances their intimidatory power. In other words, the threat of massive US retaliation alone is inadequate if Western nuclear

deterrence is to remain credible.

Chatham House Advises Restraint to the West in Dealing with Russian Nuclear Threats:

Valeryia Akimenko concludes by saying that good policy

means responding soberly to Russian nuclear threats, while at the same time ensuring that any actual nuclear use cannot go unanswered. Russia has weaponized nuclear rhetoric to great effect, evident in the near-panic that ensues every time President Putin mentions the possibility of nuclear use. The international community should recognize that this is a

Russia has weaponized nuclear rhetoric to great effect, evident in the near-panic that ensues every time President Putin mentions the possibility of nuclear use. The international community should recognize that this is a routine element of Russian state communications and should take a long view in assessing such propaganda rather than reacting to each new occasion when it is employed. Consistent long-term policy is called for instead.

routine element of Russian state communications and should take a long view in assessing such propaganda rather than reacting to each new occasion when it is employed. Consistent long-term policy is called for instead.

To close the deterrence gap, NATO must re-examine and re-emphasize its nuclear deterrent in such a way as to address the threat, however remote, of low-yield nuclear weapons being employed for limited military objectives and localized effect. It must better calibrate its

capabilities to the developments in Russia's arsenal, and address the gaps in NATO's escalatory ladder that have formed as a result. Conventional and nuclear, defensive and offensive, symmetrical and asymmetrical military countermeasures must be demonstratively available for use for maximum effect in deterring any consideration of nuclear

Above all, situations that would warrant a limited nuclear response by Western nuclear powers, such as Russian use of NSNWs or other weapons of mass destruction, should be discussed publicly to reduce Russia's confidence in Western self-deterrence. All of these measures would render Russia's nuclear threats even less realistic, and hence a less effective tool for intimidation.

use by Russia. The gulf in non-strategic nuclear capability demands policy adjustment, beyond the step already taken to fit several low-yield warheads to strategic submarine-launched

ballistic missiles. Cheaper and more credible delivery platforms, distinguishable from those designed for a strategic nuclear strike, are essential. This is not to argue for a full-on nuclear arms race.

Rather, it is essential to signal resolve, which is often lacking, as well as to demonstrate potential, which at the moment is also absent. Defensive action against the use of NSNWs, such as the hardening of high-value targets, must be considered. A coordinated division of labor is necessary both within NATO and more broadly. NATO's non-nuclear member states

and other like-minded non-nuclear nations must also contribute towards advanced conventional deterrent capabilities, including missile defense and a full range of stand-off fires. The Kremlin should not retain its monopoly on public discussion of nuclear use, and nuclear threats must be responded to rather than with panic. Russia should be challenged directly over its own toxic and irresponsible domestic and international nuclear statements.

Above all, situations that would warrant a limited nuclear response by Western nuclear powers, such as Russian use of NSNWs or other weapons of mass destruction, should be discussed publicly to reduce Russia's confidence in Western self-deterrence. All of these measures would render Russia's nuclear threats even less realistic, and hence a less effective tool for intimidation.

Given the above information on Russian nuclear weapons and her policy on the use of nuclear weapons we the people of the world would like to be hopeful for the continued prosperity of mankind.

The rise of China, albeit a wrinkle in global politics, is expected to contribute to the development of mankind. One hopes that the “limitless friendship” between Russia and China will not be able to stand in the way of the progress of democratic people regardless of the opposition by the Sino-Russian entente. Many developing countries would indeed be attracted by China’s BRI initiative aimed at developing the infrastructures of these countries that have the need but not the resources. China’s BRI initiative is attractive to developing countries because China does not impose any restrictions on the loans given to these countries. But BRI projects have been publicly criticized by the Americans in particular dubbing the initiative as Debt Trap. Such accusations, however, do not touch Russia or its policy on nuclear weapons.

Source: <https://www.dhakatribune.com/opinion/longform/336201/is-it-conceivable-for-russia-to-use-nuclear>, 08 January 2024.

NUCLEAR STRATEGY

NORTH KOREA

North Korea’s Kim Orders Military to Accelerate War Preparations

North Korea leader Kim Jong Un has ordered his country’s military, munitions industry and nuclear weapons sector to accelerate war preparations to counter what he called unprecedented confrontational moves by the U.S., state media said. Speaking on the policy directions for the new year at a key meeting of the country’s ruling party, Kim also said Pyongyang would expand strategic cooperation with “anti-imperialist independent” countries, news agency KCNA reported.

North Korea has been expanding ties with Russia,

North Korea leader Kim Jong Un has ordered his country’s military, munitions industry and nuclear weapons sector to accelerate war preparations to counter what he called unprecedented confrontational moves by the U.S., state media said.

among others, as Washington accuses Pyongyang of supplying military equipment to Moscow for use in its war with Ukraine, while Russia provides technical support to help the North advance its military capabilities.

...The 9th plenary meeting of the 8th central committee of the Workers’ Party of Korea kicked off on Tuesday to wrap up a year

during which the isolated North enshrined nuclear policy in its constitution, launched a spy satellite and fired a new intercontinental ballistic missile. The days-long assembly of the party and government officials has been used in recent years to make key policy announcements. Previously, state media released Kim’s speech on New Year’s Day.

Source: <https://www.reuters.com/world/asia-pacific/north-koreas-kim-orders-military-accelerate-war-preparations-kcna-2023-12-27/>, 28 December 2023.

RUSSIA

Russia to Use Nuclear Weapons if Attacked by Western Missiles: Medvedev

Russia could resort to the use of nuclear weapons if its launchers are attacked by Western missiles, Deputy Chairman of the Russian Security Council Dmitry Medvedev said. Medvedev made the remarks in a Telegram post in response to recent proposals by the Ukrainian side to use U.S.-supplied long-range missiles to destroy Russian launchers on Russian territory.

Russia could resort to the use of nuclear weapons if its launchers are attacked by Western missiles, Deputy Chairman of the Russian Security Council Dmitry Medvedev said. Medvedev made the remarks in a Telegram post in response to recent proposals by the Ukrainian side to use U.S.-supplied long-range missiles to

destroy Russian launchers on Russian territory. Medvedev said that this wouldn’t be a right to self-defense, but a direct and obvious basis for Russia to use nuclear weapons against such a state. He said this move would be in accordance with Russia’s nuclear doctrine, which stipulates

the right to nuclear weapons in response to "aggression against the Russian Federation with conventional weapons when the very existence of the state is threatened."

Source: <https://www.dailyexcelsior.com/russia-to-use-nuclear-weapons-if-attacked-by-western-missiles-medvedev/>, 13 January 2024.

Belarus Leader Says Russian Nuclear Weapons Shipments are Completed, Raising Concern in the Region

Belarusian president Lukashenko has announced that shipments of tactical nuclear weapons for deployment in his country are complete, marking the first such placement outside of Russia's borders. This sparked concerns in Poland and other countries in the region. The shipments of these tactical nuclear weapons were completed in October, Mr Lukashenko revealed at a meeting of a Moscow-led economic bloc in St Petersburg. However, he did not share further details regarding the quantity of weapons sent and their specific deployment locations.

These short-range tactical nuclear weapons, designated for battlefield use, have a low yield of about 1 kiloton and impact compared to more powerful nuclear warheads fitted to long-range missiles. The US believes Russia has about 2,000 tactical nuclear weapons, which include bombs that can be carried by aircraft, warheads for short-range missiles, and artillery rounds. Such weapons have a relatively short range and lower yields than nuclear warheads fitted to long-range strategic missiles. The US has approximately 200 of these tactical weapons, with half of them stationed at bases in Europe.

Belarus shares borders with three Nato members – Poland, Lithuania and Latvia. Of

these, Poland is an active ally of Kyiv and offers its neighbour military, humanitarian and political backing in the fight against Russia's invasion.

Poland is also participating in international sanctions against Russia and Belarus.

Source: <https://www.independent.co.uk/news/world/europe/russia-nuclear-weapons-belarus-lukashenko-b2469444.html>, 26 December 2023

USA–AUSTRALIA

Nuke Policy Quietly Nuked: Australia to Fund US Nuclear Weapon Delivery Program

A newly released Congressional Research Service report confirms that Australian funds will be used to support the United States Navy's nuclear ballistic missile submarine program. The Government has sunk Labor's nuclear disarmament and non-proliferation pledges.

Columbia Submarine Program:

The US Navy is replacing its current fleet of 14 Ohio class Ballistic (Nuclear) Missile submarines with 12 new Columbia class Ballistic Missile submarines. The acquisition of 12 submarines will cost US\$112B (AUD\$164B). The Columbia class submarines

will carry 16 thirteen-metre-long Trident II D5 missiles....

Fully loaded, each submarine will be able to deliver thermonuclear weapons to 128 cities or hardened military targets. The ballistic missile submarines form part of the US nuclear triad (land-based ballistic missiles, air-launched cruise missiles and bombs, and submarine-launched ballistic missiles). When on patrol, the submarines are virtually undetectable, and there are no known, near-term credible threats to the survivability of

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the SSBN force. The ballistic missile submarines are the most survivable leg of the triad. The US Navy, for more than a decade, consistently identified the Columbia Class program as its top priority program....

The Columbia class ballistic missile submarines will be built at General Dynamics' Electric Boat in Groton, Connecticut, and Huntington Ingalls Industries' Newport News Shipbuilding (HII/NNS), in Newport News, Virginia. That's exactly the same shipyards the Virginia class attack submarines will be built. And this will all be happening at the same time. The first Columbia submarine is to be delivered in October 2027, the second in April 2030, the third in August 2032, the fourth in September 2032, and the fifth in August 2033.... By 2028, it is expected that the yards will be collectively producing 2 per annum. That will meet US Navy requirements, but AUKUS takes the required production rate to 2.33 per annum. When the Columbia submarines are added to the mix, the US submarine industrial base needs to be producing 1+2.33 submarines per annum.

Source: <https://michaelwest.com.au/australia-to-fund-nuclear-missiles- aukus/> 2 January 2024.

BALLISTIC MISSILE DEFENCE

CHINA

Water-Filled Missiles, Silo Problems Behind China Purge: Report

Missiles filled with water instead of fuel and lids on silos that do not work properly were among

the factors that led to the sacking of China's defense minister and a slew of other senior officials last year, according to a recent report. These issues, blamed primarily on corruption, have in turn reportedly rattled Chinese President Xi Jinping's confidence in his country's armed forces, including its ability to conduct major operations, such as an invasion of Taiwan. It also raises questions about the readiness of China's military and its broader modernization efforts.

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Missiles filled with water instead of fuel and lids on silos that do not work properly were among the factors that led to the sacking of China's defense minister and a slew of other senior officials last year, according to a recent report. These issues, blamed primarily on corruption, have in turn reportedly rattled Chinese President Xi Jinping's confidence in his country's armed forces, including its ability to conduct major operations, such as an invasion of Taiwan. It also raises questions about the readiness of China's military and its broader modernization efforts.

Bloomberg published a story on the reported problems surrounding the PLA's Rocket Force (PLARF) this past weekend, citing unnamed individuals familiar with U.S. intelligence on the topic. The PLARF is the arm of China's military that oversees the country's arsenal of nuclear and conventionally-armed ground-based ballistic, cruise, and hypersonic missiles, as well as various supporting elements. "The U.S. assessments cited several examples of the impact of graft, including missiles filled with water instead of fuel and vast fields of missile silos in western China with lids that don't function in a way that would allow the missiles to launch effectively, one of the people said," according to Bloomberg's report.

Bloomberg did not identify the missiles in question or say how many silos were found to have improperly functioning lids. The outlet also said it could not independently verify these assessments, and that it received no further details on the record from either the White House or the Pentagon. Based on the limited information from the Bloomberg story, one immediate possibility regarding the water-filled missiles is

that this might have to do with Chinese liquid-fueled ballistic missiles. The PLARF currently has a relatively small arsenal of silo-based, nuclear-armed liquid-fueled DF-5-series IBCM. In the late 2010s, at least one brigade of older road-mobile liquid-fueled DF-4 IBCMs was also still operational, though independent experts assess those weapons to have finally been retired.

However, China's DF-5s are not understood to be kept in a fueled state by default. Liquid rocket fuel is very toxic and corrosive, in addition to being flammable and explosive. Though there are ways to mitigate these issues, this all typically makes it dangerous to keep liquid-fueled missiles fully loaded with propellant for extended periods of time. It's also one of the reasons why missiles with solid fuel rocket motors are more flexible, since they do not need to be fueled beforehand, and are generally safer overall to handle. It reportedly takes an average of 30 to 60 minutes to fuel an empty DF-5.

All of this, in turn, raises questions about when PLARF DF-5s might have been filled with water and how this was discovered. There is the possibility that they were found to have significant residual water in their tanks after defueling following training exercises or inspections, which might lead to issues when fueling them in the future.

There is also the possibility that the water may have actually been present in subcomponents on DF-5s or other Chinese ballistic missiles that are unrelated to their main rocket motors, such as post-boost vehicles. Post-boost vehicles are found on ballistic missiles (typically ICBMs) with multiple warhead configurations, also known as MIRV designs. On MIRVed missiles, the post-boost vehicle releases individual warheads over their

targets, as you can read more about here. Thrusters that use liquid propellants are generally used to orient the post-vehicle vehicle as it travels outside of the Earth's atmosphere. There is also the possibility that what was found to be full of water were tanks intended to hold fuel that would go into DF-5s before launch, not the missiles themselves. The reportedly water-filled missiles may have nothing to do with the PLARF's ballistic missile inventory, too. ...

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Source: Joseph Trevithick, <https://www.thedrive.com/the-war-zone/water-filled-missiles-silo-problems-behind-china-purge-report>, 08 January 2024.

IRAN

Online Publication Unveils Iran's New Rizvan Ballistic

Missile Specifications

The Rizvan ballistic missile, also known as Rezvan, is a single-stage liquid-fueled weapon, publicly displayed for the first time during the Holy Defense Week parade in September 2022. Designed to target strategic enemy sites within a range of 1,350 kilometers, the missile features a detachable warhead. In terms of physical dimensions, the Rizvan missile measures roughly 12 meters in length and has a diameter of 0.88 meters, resembling the Qiyam ballistic missile, which shares similar dimensions but is slightly shorter at around 11 meters.

However, a notable difference between the two missiles lies in their warhead design. Unlike the Qiyam, which uses a three-cone warhead in both guided and non-guided versions, the Rizvan employs a simpler single-cone warhead without control beams for guidance. Additionally, the Rizvan missile is equipped with jet vanes for

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thrust vector control (TVC) and stabilizers at the rear of the missile body.

In terms of destructive capability, the Rizvan missile is said to have an effective radius of 200 meters and a lethal radius of 100 meters. It's worth noting that a similar missile named Zulfiqar has been employed in Yemen, targeting installations in Saudi Arabia and the United Arab Emirates during the conflict with the Saudi military coalition.

The Yemeni variant of Zulfiqar includes a detachable warhead with guidance capabilities, known as Aqeel, which was showcased during the Yemeni Armed Forces parade on September 21, 2023.

Iran has unveiled a wide array of weaponry since November 2023, including the Fattah-2 hypersonic missile, the Heydar air-to-ground missile, the Mehran mobile air defense system, the jet-powered Shahed-238 drone, a new loitering munition known as Shahin-1, a replica of the American Switchblade 300 miniaturized kamikaze drone called Sina, and Karrar drones equipped with Majid air-to-air missiles. Additionally, the Islamic Revolution Guards Corps (IRGC) Navy of Iran has announced the development of two new air-to-air missiles designed to target and neutralize hostile drones and guided missiles, with reported ranges of approximately 4 and 17 kilometers. There are also plans to integrate AI into indigenous drones, missiles, and naval vessels.

Source: <https://www.armyrecognition.com/>

defense_news_december_2023_global_security_army_industry/online_publication_unveils_iran_s_new_rizvan_ballistic_missile_specifications.html, 28 December 2023.

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Iran's Ballistic Missile Arsenal: A Growing Threat in the Middle East

Iran regime's ballistic missile arsenal is the largest and most capable in the Middle East, with the ability to accurately strike anywhere in the region, including Israel and Eastern

Europe. Despite decades of UN sanctions aimed at containing the regime's industrial military capacity, Iran ranks sixth in the world for missile production, according to its own Ministry of Defense. The Islamic Revolutionary Guard Corps (IRGC) Aerospace Force is Iran's strategic missile force, with an estimated 15,000 soldiers dedicated to missile operations. The force was founded in 1985, but its roots trace back to 1979 when Iran was reorganizing its military after the Iranian Revolution.

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Iran's ballistic missile development began in earnest during the Iran-Iraq War (1980-1988) when Iraq launched an invasion targeting major Iranian urban areas with Scud ballistic missiles.... The Soviet Union wasn't interested in supporting Iran during its war with Iraq, but the People's Republic of China and North Korea were more than willing to play ball. Many of Iran's early missiles are based on

Chinese or North Korean rockets, and the practice of adapting East Asian missiles into current Iranian-produced versions continues today. Supporting Iran allowed China and North Korea to secure some much-needed influence on the global

stage. Iran's regime badly needed allies as well, and the bloody war with their neighbor Iraq reinforced the lesson that they needed a strong deterrent against future aggression.

Ballistic missiles are particularly attractive to developing militaries like Iran because they're a cheap form of force projection compared to a large air force or navy. They allow a country to threaten to strike far from their borders without much required training, and it's hard for defenders to stop them. As the country's technology and military-industrial level increase over time, their missiles naturally evolve in range, accuracy, and payload. Its missile program is seen as a way to deter any potential aggression from these countries. Iran has also been involved in proxy wars in Syria, Iraq, and Yemen, and its missiles are seen as a way to project power and influence in the region.

Iran has shown a willingness to endure economic hardship in order to maintain its military capabilities, and it is unlikely to abandon its missile program anytime soon even at the cost of the people's increasing impoverishment. The international community will need to find a way to address the underlying security concerns that drive the regime's missile development, while also finding ways to constrain the program and prevent the proliferation of missile technology to other countries in the region.

Source: <https://irannewsupdate.com/news/general/irans-ballistic-missile-arsenal-a-growing-threat-in-the-middle-east/>, 30 December 2023.

SOUTH KOREA

South Korea Increases Pace on Missile Shield Development

South Korea's Defense Acquisition Program Administration (DAPA) announced in early January that it is accelerating development of the Low-

Altitude Missile Defence (LAMD) system – nicknamed the “Korean Iron Dome” by some observers – by a year as a countermeasure against North Korean long-range artillery. DAPA noted that further development and production of the LAMD system will be carried out from 2025 to 2028.

The effort is being led by DAPA's Agency for Defense Development (ADD) with industrial partner LIG Nex1, which began conceptualisation and early development of the system in early 2022. Core developmental activities were completed around June 2023. The LAMD is the lower-tier

segment of the broader Korea Air and Missile Defense (KAMD) system designed to protect the country against a range of threats such as aircraft, artillery, cruise missiles, and UAVs, long-range at low altitudes.

According to DAPA and LIG Nex1, a typical LAMD

battery comprises a radar, engagement control centre, launcher, and interceptor missiles. The missiles are expected to be capable of engaging targets out to 7 kilometres and will feature active radar seekers for terminal guidance. The missile interceptor was test-fired for the first time in March 2022 and is based on the Korean Surface-to-Air Anti-Missile (K-SAAM). South Korea also employs the LIG Nex1 Cheongung II medium-range SAM (M-SAM) and the US-made MIM-104 Patriot SAM as countermeasures against ballistic missiles at lower altitudes. DAPA added that development of the upper-tier element of the KAMD system – the L-SAM – is expected to be completed in 2024. The L-SAM is designed to intercept ballistic missiles out to 150 kilometres away and at altitudes between 40 and 100 kilometres. The system has been under development by ADD and LIG Nex1 since 2019.

Source: <https://www.asianmilitaryreview.com/2024/01/south-korea-increases-pace-on-missile-shield-development/>, 05 January 2024.

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RUSSIA

All You Need to Know About Kh-47/M2 Kinzhal Ballistic Missile

The Kh-47/M2 Kinzhal (Dagger) is a nuclear-capable, aero ballistic missile (NATO designation Killjoy). It was designed by the Moscow Institute of Thermal Technology (MITT) in the early 2010s as a response to the development of advanced anti-missile defense systems by Western countries. It is generally believed to be a modified version of the ground-based Iskander-M SRBM that was also produced at the MITT.

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The missiles are manufactured by the Kolomna Machine-Building Design Bureau (KBM), part of the Rostec Corporation, located around 50 kilometers southeast of the Russian capital. It was one of six “next generation” weapons first publicly revealed by Russian President Putin during his annual address to the Federal Assembly on March 1, 2018. Putin claimed that the missile had been undergoing successful tests since December 2017.

In the middle of October, Putin announced that the Kinzhal-equipped Mig-31K would be deployed to patrol the Black Sea. On Jan. 2, Russia fired another 10 Kinzhals at Ukraine’s capital, all of which appear to have been successfully intercepted. The reasons for this may be down to the increased number of air defense assets Ukraine now holds, or the experience gained in tackling the missiles.

He declared the missile as being hypersonic – the accepted definition of which means one that flies more than five times the speed of sound. In reality, it is not a true hypersonic missile as it only reaches hypersonic speed during the final part of its trajectory and can’t maneuver at such speeds while “cruising.” It is launched from modified MiG-31K fighter-interceptors or Tu-22M3M and Tu-160 strategic bombers, and possibly the SU-57 “stealth” fighter... .

The total number of Kinzhals, each of which cost around \$10 million, that have been produced and

held by Russia is a closely held secret. It was estimated prior to Russia’s full-scale invasion a Ukrainian intelligence report suggested that only around 50 units were held. It is not clear how many the KBM plant is capable of producing and it is known that the missiles are highly reliant on electronics that have been hampered by sanctions (although not entirely prevented, according to the Russian news outlet Insider).

In a June report, the Yermak-McFaul Group identified that the Kinzhals, as with many other Russian-made missiles, rely on foreign, mainly US components for their production of the rocket. In the middle of October, Putin announced that the Kinzhal-equipped Mig-31K would be deployed to patrol the Black Sea. On Jan. 2, Russia fired another 10 Kinzhals at Ukraine’s capital, all of which appear to have been successfully intercepted. The reasons for this may be down to the increased number of air defense assets Ukraine now holds, or the experience gained in tackling the missiles.

Source: <https://www.kyivpost.com/post/26235>, 02 January 2024.

USA

Navy Shoots Down Ballistic Missiles Launched by Iran-Backed Houthis in Red Sea

The USS Carney, a U.S. Navy guided-missile destroyer in the northern Red Sea, on Thursday shot down multiple missiles and drones launched by Iranian-backed Houthis in Yemen that the Pentagon said were potentially headed toward targets in Israel. It is the first time in recent memory that a U.S. Navy ship in the Middle East has engaged missiles and drones that were not directly aimed at the vessel. It’s also the first U.S.

military action taken to defend Israel in the current crisis and with the U.S. and other countries trying to contain the conflict between Israel and Hamas, the possibility that an Iranian-backed proxy group fired missiles and drones at Israel is sure to increase growing regional tensions.

The ship was in the Red Sea on Thursday evening local time when it intercepted three land attack cruise missiles and several drones, Pentagon spokesman Brig. Gen. Pat Ryder said at a press briefing. U.S. officials on Friday told ABC News that the Carney had brought down four cruise missiles and 14 drones launched by the Houthis, an update from the three missiles and eight drones reported earlier. The preliminary U.S. assessment was that the USS Carney was not the target of any of the Houthi missiles or drones, according to multiple U.S. officials.

Thursday's incident occurred during the early evening hours (local time) when the missiles and drones were detected moving northward above the waters of the Red Sea. The missiles fired by the Houthis were engaged by SM2 missiles carried aboard the USS Carney, a U.S. official told ABC News. No information was released about what

weapons platform aboard the Carney brought down the 8 drones. The USS Carney had just transited into the Red Sea through the Suez Canal on Wednesday which is why the destroyer was still located in the northern stretch of that body of water that borders, Egypt, Egypt's Sinai Peninsula, Sudan, Saudi Arabia, and Yemen.... The risk to U.S. forces and U.S. interests in the region has increased particularly in the wake of a deadly explosion at a hospital in Gaza earlier this week that inflamed regional tensions.

On Wednesday, three drones were shot down by U.S. military forces as they neared bases in western and northern Iraq, another drone was shot down near U.S. forces in eastern Syria on

Thursday.... The Carney's shutdown of Houthi missiles opens up the possibility that the U.S. Navy may have to position more ships in the Red Sea if the U.S. commits to protecting Israel from a southern attack said Steve Ganyard, an ABC News contributor and a former Pentagon official.

Source: <https://abcnews.go.com/International/security-incident-involving-us-navy-destroyer-red-sea/story?id=104147141>, 27 December 2023.

NUCLEAR ENERGY

CHINA

China Approves Construction of Four New Reactors

The construction of two Hualong One reactors at each of the Taipingling and Jinqimen sites was approved by China's State Council at a 29 December meeting. Meanwhile, various milestones have been reached in the construction of other Chinese units. At the meeting of the Standing Committee of the State Council, chaired by Chinese Premier Li Qiang, approval was granted for units 3 and 4 at China General Nuclear's (CGN's) existing Taipingling nuclear power plant in Guangdong province, as well as units 1 and 2 at China National Nuclear Corporation's (CNNC's) new Jinqimen nuclear power plant in Zhejiang province.

The Taipingling plant will eventually have six Hualong One reactors. The construction of the first and second units began in 2019 and 2020, respectively. Unit 1 is scheduled to start up in 2025, with unit 2 following in 2026. Units 1 and 2 of the Jinqimen plant - which CNNC notes have been included in the national plan and have undergone a comprehensive safety assessment review - have also been approved. CNNC subsidiary CNNC Zhejiang Energy Co Ltd will be responsible for project investment, construction and operations management of the new plant.

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On 31 July last year, China's State Council approved the construction of six nuclear power units: units 5 and 6 of the Ningde plant in Fujian Province; units 1 and 2 of the Shidaowan plant in Shandong Province; and units 1 and 2 of the Xudabao plant in Liaoning Province. The latest approvals bring the total number of nuclear power projects approved in 2023 to ten, the same number approved in 2022.

Construction Milestones:

The Hualong One design features a double-layered containment structure. The main function of the containment building is to ensure the integrity and leak tightness of the reactor building, and it plays a key role in the containment of radioactive substances....

The first safety-related concrete was poured for the nuclear island of Sanmen 3 on 28 June, marking the official start of its construction. Phase II (units 3 and 4) of the Sanmen plant - which already houses two operating Westinghouse AP1000 units - will comprise two CAP1000 reactors, the Chinese version of the AP1000. The units are scheduled to start up in 2027 and 2028, respectively.

Source: <https://world-nuclear-news.org/Articles/China-approves-construction-of-four-new-reactors>, 03 January 2024, 02 January 2024.

How the World's First Fourth-Generation Nuclear Power Plant Works

The world's first fourth-generation nuclear power plant, Huaneng Shandong Shidao Bay Nuclear Power Plant in eastern China's Shandong Province,

went into commercial operation on December 6, 2023 and has been running well, according to officials at the plant. The power plant has drawn global attention as it adopts High Temperature Gas-Cooled Reactor-Pebble-bed Module (HTR-PM), which is claimed to be able to steer away from a meltdown or leak of radioactive materials even in extreme conditions. "In the past few weeks of its commercial use, our two reactors in the power unit have maintained the initial full power stable operation. They generate electricity every day with the power of 150 megawatts," said Zhang Yijin, a chief operator at the power plant.

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"The state of the unit, including the operation of various parameters are very stable. Then the electricity we generate is supplied to the Shandong power grid and distributed for use," he added. One of the major features of the fourth-generation reactors is the nuclear fuel which is made into a small sphere shaped like a tennis ball, and each reactor has up to 430,000 of them. "This sphere is 6 centimeters in diameter, and inside it, are 12,000 one-millimeter coated fuel particles. And inside the particles, there's a very small fuel core, and four layers of ceramic armor," said Tong Liyun, another chief operator at the plant.

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"The entire ceramic armor can withstand very high temperatures, and under any working conditions, the temperature of the fuel ball will not exceed the temperature that the ceramic armor can tolerate," Tong said. He stressed that in this way, the design ensures that radioactive materials will

not leak out. The operator said that each sphere has the energy equal to 1.5 tonnes of coal and there is no need for the usual procedure of temporarily shutting down reactors for refueling, allowing constant operation. The operating reactors are cooled by the inert gas helium instead of water. And they also use a passive residual heat removal system which is the key assurance for the inherent safety of high-temperature gas-cooled reactors.

Construction of the power plant began in 2012. It was connected to the grid in 2021 and went into commercial operation in 2023. It is expected to contribute to the region's electricity supply and set an example for further development of fourth-generation nuclear power plants. In safely using nuclear energy, China is utilizing its own third-generation nuclear power technologies like "Hualong-One" and the country is making concrete steps towards more advanced technologies like the one used in Shidao Bay.

Source: Zheng Yibing, <https://news.cgtn.com/news/2024-01-06/How-the-world-s-first-fourth-generation-nuclear-power-plant-works-1q8JzrGNrj2/p.html>, 06 January 2024.

FRANCE

As Nuclear Debate Nears, French Minister Sees Potential for 14 New Reactors

France requires more than the six new nuclear plants currently planned and possibly needs to build more than 14 new plants, its energy minister said, just days before a parliamentary debate begins on the issue. Speaking to weekly newspaper La Tribune Dimanche, Energy Transition Minister Agnes Pannier-Runacher said it was vital to build more nuclear reactors and increase France's renewable energy mix to reduce the country's dependence on fossil fuels to 40%

from 60% by 2035.

"We need nuclear power beyond the first six EPRs (European Pressurised Reactors) since the existing (nuclear) park will not be eternal," Pannier-Runacher said, adding that post-2026 additional needs would be equivalent to 13 gigawatts corresponding to eight EPRs. President Macron in 2022 placed nuclear power at the heart of his country's drive for carbon neutrality by 2050, announcing the construction of six new European Pressurised Reactor reactors and studies for a further eight reactors.

The new plants are to be built and operated by state-controlled energy provider EDF with tens of billions of euros in public financing mobilized to finance the projects and safeguard EDF's finances. The new energy strategy must be codified into law and is set to be debated in parliament from late January. Macron's decision to extend the lifespan of existing nuclear plants to more than 50 years from 40 years for certain reactors marked a U-turn on an earlier pledge to close more than a dozen of EDF's 56 reactors by 2035. He has also promised to accelerate the development of solar and offshore wind power.

Source: <https://www.reuters.com/world/europe/nuclear-debate-nears-french-minister-sees-potential-14-new-reactors-2024-01-07/>, 07 January 2024.

INDIA

Reimagining Nuclear: Tens of Thousands of Micro Reactors

An idea for enabling "tens of thousands of micro nuclear reactors", of capacities like 2 MW or 5 MW, producing electricity at around 1 2.5 a kWhr,

President Macron in 2022 placed nuclear power at the heart of his country's drive for carbon neutrality by 2050, announcing the construction of six new European Pressurised Reactor reactors and studies for a further eight reactors.

An idea for enabling "tens of thousands of micro nuclear reactors", of capacities like 2 MW or 5 MW, producing electricity at around 1 2.5 a kWhr, has started making rounds as a whisper-in-the-corridor among scientists and policy makers.

has started making rounds as a whisper-in-the-corridor among scientists and policy makers. Recently, Ashok Jhunjhunwala, the septuagenarian President of IIT Madras Research Park, which is an IIT-Madras-mentored incubation centre, held a “brain-storming session” with several scientists, to discuss the idea. Those present included Anil Kakodkar, one of India’s most renowned nuclear scientists, Arun Kumar Nayak, Head of Nuclear Control and Planning Wing, Department of Atomic Energy and several professors from institutions such as IIT Madras and IIT Jammu.

For some time, the world has been talking about ‘small modular reactors’, of around 100 MW or less, but the idea ‘micro reactors’ takes this much further. The purpose of the brainstorming session was to develop a framework—details to be filled in over the next three months—for ‘micro modular nuclear reactors’ of sizes that can be put up on the premises of educational institutions or basements of residential condominiums. The session discussed issues such as safety, type of reactors, type of fuel, coolants, land requirement, reprocessing and waste disposal, regulations and applications.

At the end of the session, the group concluded that ‘micro nuclear reactors’ is not an outlandish idea—it is doable. Experts mentioned that Westinghouse has designed an eVinci micro reactor, of 13 MW (thermal) capacity. (The Russian company, Rosatom, intends to build 10 MWe ‘SHELF-M’ reactors by 2030.) It was also mentioned that such reactors are also being discussed in the DAE. But India should have a micro modular nuclear reactor of its own, designed for and made in India.

Making MMNRs Work: Kakodkar, who was the

principal thought-leader during the discussion, said at the outset that if you go to the regulator and ask him to write regulations for micro nuclear reactors, the regulator will say, “what is your design?” But the designer would first want to know what the regulations are — a catch-22 situation. Therefore, the reactor should be designed in such a way that it conforms to the existing regulations.

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Having said that the top priority should be for fool-proof safety — it should shut down on its own in case of any radiation leak, without any human intervention. There must be no heating up of the reactor core. Such reactors are called ‘walk away safe’ reactors—they are capable of cooling themselves, and, if the cooling system fails,

they can be cooled by ambient air. Further, it should be possible for the reactor operator to close it down (say) for the night and go home.

Secondly, all the fuel should come from and the spent fuel should go back to, the Department of Atomic Energy.

Then, how big may the reactor be? The suggestion was for a 5 MWe reactor, 3-metre-tall and 2-meter diameter, capable of being transported in a shipping container. The suggestion for the fuel was for 19.75 per cent enriched uranium (2.7 tonnes of Uranium Oxide containing 540 tonnes of U-235), which would require refuelling after 15 years.

Transporting fuels was not believed to be an insurmountable problem. Third, Kakodkar stressed that the reactor should be a high-temperature reactor, for the sake of higher efficiency. This, in turn, ruled out metals for making the reactors, as metals would melt. Instead,

ceramics should come into play.

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As for the costs, Dr Jhunjhunwala set a 'target' of 1.71 per kWhr as the 'capex cost'; along with the operating costs, the total cost of energy produced should be around 2.5 a kWhr. Nayak mentioned that there have been some informal conversations have happened with manufacturers like L&T and users like the steel industry, for SMRs.

L&T has said it can produce SMRs; steel manufacturers, Nayak said, were interested in having several hundred reactors to produce hydrogen, to replace coke, in steel making. Prof Sreenivas Jayanthi of IIT Madras said that the reactors should be made ASAP – with the 'S' standing for 'soon', 'simple', 'safe' and 'self-regulating'. "We should be able to make it happen in five years," he said.

<https://www.thehindubusinessline.com/news/science/reimagining-nuclear-tens-of-thousands-of-micro-reactors/article67734280.ece>, 12 January 2024.

JAPAN

Japan Lifts Operational Ban on World's Biggest Nuclear Plant

Japan's nuclear power regulator on 27 Dec lifted an operational ban imposed on Tokyo Electric Power's (9501.T) Kashiwazaki-Kariwa nuclear power plant two years ago, allowing it to work towards gaining local permission to restart. Tepco has been eager to bring the world's largest atomic power plant back online to slash operating costs, but a resumption still needs consent from the local governments of Niigata prefecture, Kashiwazaki city and Kariwa village, where it is located. When that might happen is unknown. With capacity of 8,212 MW, the plant has been offline since 2012

after the Fukushima disaster a year earlier led to the shutdown of all nuclear power plants in Japan at the time.

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corrective action order that had prevented Tepco from transporting new uranium fuel to the plant or loading fuel rods into its reactors - effectively blocking a resumption.

The Institute of Energy Economics, Japan (IEEJ) forecast that Japan's LNG imports would decline to 58.5 million metric tons in the 2024/25 fiscal year from an estimated 64 million tons this year. The fall factors in the anticipated restarts of a few more nuclear reactors and an increase in renewable energy sources.

In 2021, the Nuclear Regulation Authority (NRA) barred Tepco from operating Kashiwazaki-Kariwa, its only operable atomic power station, due to safety breaches including the failure to protect nuclear materials and missteps that saw an unauthorised staff member accessing sensitive areas of the plant. Citing improvements in the safety management system, the NRA on Wednesday lifted a

Resources-poor Japan is eager to bring more of its nuclear power plants online to reduce its reliance on imported fossil fuels such as liquefied natural gas (LNG). The Institute of Energy Economics, Japan (IEEJ) forecast that Japan's LNG imports would decline to 58.5 million metric tons

in the 2024/25 fiscal year from an estimated 64 million tons this year. The fall factors in the anticipated restarts of a few more nuclear reactors and an increase in renewable energy sources. Shares in Tepco had soared after the NRA indicated early this month that it would consider lifting the operational ban after conducting an on-site inspection and meeting with the company's president.

Source: *<https://www.reuters.com/business/energy/worlds-biggest-nuclear-plant-japan-resume-path-towards-restart-2023-12-27/>, 27 December 2023.*

TURKEY

From Black Sea Gas Low to Nuclear Milestone: Türkiye's 2023 Energy Dossier

The year 2023 has been marked by multiple breakthroughs that place Türkiye a step closer on its path to eliminating its heavy external dependency on energy resources. The advancements ranged from an increase in international cooperation between Türkiye and international players in natural gas, the first gas flow from the vast reserve in the Black Sea to a milestone in the country's first nuclear plant, which officially achieved nuclear status.

1st Nuclear Plant: Construction is ongoing for the country's first nuclear power plant in the southern Mersin province. On April 27, the Akkuyu Nuclear Power Plant gained official "nuclear facility" status, and the first nuclear fuel was sent from Russia to Türkiye, marking an important stage in the country's nuclear journey spanning more than half a century. Energy and Natural Minister Alparslan Bayraktar confirmed on Oct. 5 that the first reactor would start operations on Oct. 29, 2024. On Dec. 12, Akkuyu Nuclear Company received permission from the Turkish Nuclear Regulatory Authority to operate the first power unit, having submitted its first batch of documents on March 17 and its second on Aug. 24 for commission authorization.

Source: <https://www.dailysabah.com/business/energy/from-black-sea-gas-flow-to-nuclear-milestone-turkiyes-2023-energy-dossier>, 31 December 2024.

UK

EDF Energy Aims to Extend Life of UK Nuclear Power Plants

EDF Energy aims to extend the life of its nuclear plants in Britain and invest a further 1.3 billion pounds (\$1.7 billion) in its operational UK nuclear fleet to maintain output at current levels and energy security, the firm said on Tuesday. Several

countries in Europe, including France, Belgium and Sweden, have announced plans to extend the operating lives of ageing nuclear reactors due to fears about a power supply crunch in the next few years. In the European Union and Britain, most reactors were built in the 1970s and 1980s and were commissioned to last about 30 years.

EDF said it aims to keep four advanced gas-cooled reactor (AGR) plants running longer than planned - Torness, Heysham 1 and 2 and Hartlepool - subject to regulatory approval and will make a decision by the end of this year. Last year, it extended the life of its Hartlepool and Heysham 1 nuclear plants by two years to 2026. It is also examining the potential for its Sizewell B plant to run for 20 years longer than scheduled. That plant is a pressurised water reactor-type plant and has a capacity of 1.2 GW.

EDF Energy operates five nuclear plants in Britain which generate electricity and three which are defuelling due to decommissioning. The output of EDF's UK nuclear fleet was 37.3 terawatt hours last year, 15% lower than the year before due to station closures and statutory outages. The company aims to maintain output at 2023's level until at least 2026. While building a new nuclear plant can take decades and cost billions of euros, investing in a lifetime extension can be done for less money and take place gradually. The cost of EDF's new nuclear plant in south-west England, Hinkley Point C, has spiralled and it is not expected to come online until at least 2027. Another new plant in south-east England - Sizewell C - is not expected to be operational until mid-2034.

Source: <https://www.reuters.com/business/energy/edf-energy-aims-extend-life-uk-nuclear-power-plants-2024-01-09/>, 09 January 2024.

UK Releases Roadmap to Quadruple Nuclear Energy Capacity

The British government has launched a roadmap for reaching its ambition for the UK to have 24

EDF said it aims to keep four advanced gas-cooled reactor (AGR) plants running longer than planned - Torness, Heysham 1 and 2 and Hartlepool - subject to regulatory approval and will make a decision by the end of this year.

GWe of nuclear generating capacity by 2050, representing about 25% of the country's projected electricity demand. It said the Civil Nuclear Roadmap "outlines plans for the biggest expansion of nuclear power for 70 years to reduce electricity bills, support thousands of jobs and improve UK energy security - including exploring building a major new power station and investing in advanced nuclear fuel production". Nuclear's share of energy in the UK is currently about 16%, however all but one of its existing reactors are due to retire by 2030. The roadmap "will give industry certainty of the future direction of the UK's ambitious nuclear programme, on top of the government's historic commitment to Sizewell C and world-leading competition to develop SMR technology," the government said.

The plans include next steps for exploring a large-scale nuclear power plant as well as SMRs. The roadmap also includes a government ambition to secure 3-7 GW worth of investment decisions every five years from 2030 to 2044 on new nuclear projects. According to the government, plans to streamline the development of new nuclear power plants and introduce smarter regulation could speed up the overall process and, as a result, the delivery of nuclear power in the UK. This includes allowing regulators to assess projects while designs are finalised, and better cooperation with overseas regulators assessing the same technology.

The British government has launched a roadmap for reaching its ambition for the UK to have 24 GWe of nuclear generating capacity by 2050, representing about 25% of the country's projected electricity demand. It said the Civil Nuclear Roadmap "outlines plans for the biggest expansion of nuclear power for 70 years to reduce electricity bills, support thousands of jobs and improve UK energy security - including exploring building a major new power station and investing in advanced nuclear fuel production". Nuclear's share of energy in the UK is currently about 16%, however all but one of its existing reactors are due to retire by 2030.

Nuclear is the perfect antidote to the energy challenges facing Britain - it's green, cheaper in the long term and will ensure the UK's energy security for the long-term," said Prime Minister Rishi Sunak. "This is the right long-term decision and is the next step in our commitment to nuclear power, which puts us on course to achieve net-zero by 2050 in a measured and sustainable way. This will ensure our future energy security and create the jobs and skills we need to level up the country and grow our economy.

Earlier this week, the government announced it will also invest up to GBP300 million (USD381 million) in UK production of HALEU, which is currently only commercially produced in Russia. HALEU - uranium enriched to between 5% and 20% uranium-235 - will be used in the advanced nuclear fuel required for most of the next-generation reactor designs currently under development.

The government has also published two consultations, one on a new approach to siting future nuclear power plants and another on supporting the sector and encouraging private investment to roll out advanced nuclear projects. The proposals aim to "attract investment in the UK nuclear sector by

empowering developers to find suitable sites rather than focusing on eight designated by government".

The roadmap says: "The coming years are expected to bring further clarity on the costs and effectiveness of new nuclear technology. This may require us to re-evaluate some of our strategies and policies for the long term. To take account of these developments, we

therefore intend to publish a Roadmap 'update' by the end of 2025." "Nuclear is the perfect antidote to the energy challenges facing Britain - it's green, cheaper in the long term and will ensure the UK's energy security for the long-term," said Prime Minister Rishi Sunak. "This is the right long-term decision and is the next step in our

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Source: <https://world-nuclear-news.org/Articles/UK-releases-roadmap%C2%A0to-quadruple-nuclear-energy-ca>, 11 January 2024.

NUCLEAR COOPERATION

CHINA–IAEA

China and IAEA Hold Joint Nuclear Energy Management School

Around 40 young nuclear professionals from 23 countries participated in specialized training on areas relevant to the entire nuclear energy lifecycle, to expand on their technical competencies and future managerial skills required to support national nuclear energy strategies. The Nuclear Energy Management (NEM) School took place at the end of October in China, a country with 55 nuclear power reactors in operation, and where more than one third of the world's nuclear newbuilds are being constructed. The school offered lectures on various topics related to the peaceful uses of nuclear technology, from energy and sustainability to safety, security and safeguards.

The NEM School was organized by the IAEA and Nuclear Industry College (NIC), with financial support from the China National Nuclear Corporation (CNNC). The curriculum included presentations by the IAEA and local experts on nuclear energy topics such as advanced nuclear technologies, human resource development, economic aspects, stakeholder engagement, safety, security, safeguards and legal aspects. The

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school also provided an overview of good practices in sustainable development of nuclear energy, and included technical visits to nuclear facilities at Fuqing Nuclear Power Plant, China Institute of Atomic Energy, Institute of Nuclear and New Energy Technology, Tsinghua University (Changping Campus), Hualong Nuclear Power Technology Co., Ltd, and HTA Co., Ltd.

Gao Lei, President of the NIC said, "The NIC is pleased with the opportunity to contribute to the sustainable development of nuclear talent for IAEA Member States. I sincerely hope participants could share and spread the knowledge they gained in the school." As China and other countries continue to expand their nuclear fleet, the education, training and development provided by IAEA NEM schools will continue to help advance students' competencies and skill sets. The schools are a key IAEA mechanism to support the development

of a robust future nuclear workforce, which is an integral part and backbone of all nuclear power programmes.

Source: <https://www.iaea.org/newscenter/news/china-and-iaea-hold-joint-nuclear-energy-management-school>, 28 December 2023.

FRANCE–SWEDEN

France and Sweden Plan Nuclear Cooperation

France and Sweden have signed a declaration of intent to develop long-term cooperation in the field of nuclear energy. The declaration was signed in Brussels on 19 December by Sweden's Deputy PM and Energy & Industry Minister Busch and France's Energy Minister Runacher. The declaration calls for the two countries, among other things, to exchange experiences regarding financing models for the expansion of new nuclear power and encourage increased cooperation between the Swedish and French nuclear power industries. In addition, the countries will exchange

technical experience in reactor maintenance, as well as lifetime and power upgrades of existing nuclear power reactors.

In the field of the nuclear fuel cycle, the countries will seek to reinforce the security of supply of nuclear materials and fuels “by endeavouring to promote cooperation between their industries to diversify supply and reduce EU dependence on Russian nuclear materials and services”. They will also aim to strengthen bilateral cooperation in the field of used fuel management, radioactive waste management and the associated logistics operations.

The countries noted the close relations that exist between their nuclear regulators, the French Nuclear Safety Authority and the Institute for Radiation Protection and Nuclear Safety and the Swedish Radiation Safety Authority. Last month, the Swedish government unveiled a roadmap which envisages the construction of new nuclear generating capacity equivalent to at least two large-scale reactors by 2035, with up to ten new large-scale reactors coming online by 2045.

Source: <https://www.world-energy.org/article/39170.html>, 27 December 2023

GENERAL

IAEA Adds Four States for the New COMPASS Cycle

Bangladesh, Bolivia, Cameroon and Ghana will participate in the next cycle of the IAEA Comprehensive Capacity-Building Initiative for

SSACs and SRAs. The initiative, commonly known as COMPASS, involves partnering with a State to help strengthen the effectiveness of their State system of accounting for and control of nuclear material (SSAC) and State or Regional Authority responsible for safeguards implementation (SRA).

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Through safeguards, the IAEA verifies that States are honouring their international legal commitments to use nuclear material and technology only for peaceful purposes. Launched in September 2020 by the DG, COMPASS provides comprehensive safeguards assistance tailored to a State's needs. During its initial pilot phase, seven States received support from the IAEA and COMPASS's implementing partners in the areas of outreach; legal and regulatory frameworks; training; information technology; procurement; and related expertise. The IAEA successfully concluded the pilot phase in March 2023.

Bangladesh, Bolivia, Cameroon and Ghana will participate in the next cycle of the IAEA Comprehensive Capacity-Building Initiative for SSACs and SRAs. The initiative, commonly known as COMPASS, involves partnering with a State to help strengthen the effectiveness of their State system of accounting for and control of nuclear material (SSAC) and State or Regional Authority responsible for safeguards implementation (SRA).

The individual needs of new COMPASS States will be assessed through an IAEA Safeguards and SSAC advisory service (ISSAS) mission at the start of the new implementation phase, which will begin in January 2024. COMPASS activities will then be conducted collaboratively between the State and the IAEA, with the in-kind and/or financial support of individual IAEA Member States and Member State Support Programmes.

As per their respective comprehensive safeguards agreements with the IAEA, 182 States are obliged to establish and maintain an SSAC. As the State's mechanism through which it declares to the IAEA the location, uses and quantities of nuclear material in the country, SSACs are important

components of IAEA-State cooperation. The need for a robust SSAC becomes particularly evident when a State is at a pivotal juncture in the development of its nuclear fuel cycle or associated legislation. This includes the planning and construction of a new nuclear facility, agreeing to the revised text of a small quantities protocol, or bringing into force an additional protocol — each of which entail new reporting obligations for the State.

The IAEA provides a suite of safeguards assistance to States. In addition to COMPASS, States can request and access support including ISSAS missions; national, regional, and inter-regional training offerings; e-learning modules; and the safeguards traineeship programme.

Source: <https://www.iaea.org/newscenter/news/iaea-adds-four-states-for-the-new-compass-cycle>, 28 December 2023.

INDIA–RUSSIA

India, Russia Sign Deal for Future Units at Nuclear Power Plant

The agreements on Kudankulam were signed during a 25 December meeting on bilateral economic cooperation between Jaishankar and Russia's Deputy PM Manturov. According to the Indian Ministry of External Affairs, three documents relating to the plant were signed during the visit as well as a Memorandum of Understanding on cooperation in pharmaceuticals and healthcare and a Protocol on Foreign Office Consultations. The ministry did not provide further details of the agreements.

Jaishankar also held meetings with Foreign Minister Lavrov and President Putin during his visit to Moscow. India's energy relationship with Russia is "very substantial" with India seeking to expand its investments in Russia, in oil and gas, Jaishankar said at a press conference following his meeting

with Lavrov. "As also in nuclear; yesterday we signed two important amendments, which will take the Kudankulam nuclear power project forward," he said. ...

Source: <https://www.world-nuclear-news.org/Articles/Russia,-India-sign-Kudankulam-agreements>, 27 December 2023.

URANIUM PRODUCTION

UK

UK Announces Europe's First High-Tech Uranium Fuel Plant

Britain intends to become the first European country to produce an advanced uranium fuel that is currently commercially available only from Russia, the government announced Sunday. The UK government said it would invest £300 million (\$382 million) building a HALEU

programme that would help "displace" Moscow from global energy markets. "We stood up to (Vladimir) Putin on oil and gas and financial markets. We won't let him hold us to ransom on nuclear fuel," energy secretary Claire Coutinho said in a statement. "This will be critical for energy security at home and abroad and builds on Britain's historic competitive advantages," she added.

HALEU fuel is needed to power many of the next generation of advanced nuclear reactors, including so-called small modular versions that the UK intends to use. The fuel has a uranium-235 content of between five and twenty percent, above the five percent level that powers most nuclear plants currently in operation. HALEU production has recently begun in the United States, but only a Russian facility manufactures the uranium on a commercial scale, according to the International Atomic Energy Agency.

The British investment is part of plans to deliver up to 24 gigawatts of electricity from nuclear

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power by 2050, a quarter of the United Kingdom's electricity needs. The first plant will be in northwest England and is scheduled to be operational by the 2030s, the government said. It hopes to get 95 percent of Britain's electricity from low-carbon sources by 2030, with full decarbonisation of the grid by 2035. Prime Minister Rishi Sunak came under fire recently for pushing back by five years to 2035 a ban on the sale of all petrol and diesel cars. Critics said it would make achieving the UK's target of net-zero emissions by 2050 more difficult.

Source: <https://cambodianess.com/article/uk-announces-europes-first-high-tech-uranium-fuel-plant, 07 January 2024>.

USA

US Seeks to Jump-Start Production of Higher-Energy Uranium Now Made in Russia

The U.S. is seeking bids from contractors to help establish a domestic supply of a uranium fuel enriched to higher levels for use in a next generation of reactors, a fuel currently only available in commercial levels from Russia, the Department of Energy said on Tuesday. The DOE is seeking contracts for a maximum of 10 years from enrichment service companies to produce so-called high assay low enriched, or HALEU, uranium fuel that is enriched up to 20%, compared with traditional uranium fuel used in today's reactors of about 5%. The department has about \$500 million in funding for HALEU production from the 2022 Inflation Reduction Act, and sought proposals late last year for additional HALEU production services. The

The British investment is part of plans to deliver up to 24 gigawatts of electricity from nuclear power by 2050, a quarter of the United Kingdom's electricity needs. The first plant will be in northwest England and is scheduled to be operational by the 2030s, the government said. It hopes to get 95 percent of Britain's electricity from low-carbon sources by 2030, with full decarbonisation of the grid by 2035.

program could be expanded in coming years, depending on congressional appropriations. HALEU is expected to be needed for a planned generation of reactors in the works by companies including X-energy and TerraPower, but output has been delayed as the reactors are not yet built.

President Biden's administration sees the new reactors and maintaining the current fleet of nuclear plants as critical for its climate change agenda. Ali Zaidi, Biden's national climate adviser, said

boosting domestic uranium supply will increase energy security, generate high-paying union jobs, and boost economic competitiveness. Nuclear proliferation experts warn that an increased dependency on HALEU around the world could increase proliferation risks because the fuel is closer to fissile material for nuclear weapons than traditional fuel. The only company currently selling commercial shipments of HALEU is TENEX, part of Russia's state-owned energy company Rosatom.

Source: [https://www.reuters.com/world/us/us-seeks-jump-start-production-higher-energy-uranium-now-made-russia-](https://www.reuters.com/world/us/us-seeks-jump-start-production-higher-energy-uranium-now-made-russia-2024-01-09/)

[2024-01-09/](https://www.reuters.com/world/us/us-seeks-jump-start-production-higher-energy-uranium-now-made-russia-2024-01-09/), 10 January 2024.

NUCLEAR PROLIFERATION

IRAN

Iran Defends Higher Uranium Enrichment, Calls It "Peaceful" Despite Western Concerns

Iran's foreign ministry said on Friday that its increased uranium enrichment was a necessary component of its peaceful nuclear program, despite objections from the US, France, Germany,

and Britain. "Enrichment at 60 percent level in Iran's enrichment centers has always been and will continue to be in accordance with the peaceful needs of the country and fully under the supervision of the IAEA," foreign ministry spokesperson Nasser Kanaani told state media.

Western nations denounced Iran for increasing the production of highly enriched uranium, following months of decline, according to a watchdog. In a joint statement, Britain, France, Germany, and the US said they "condemn this measure that further aggravates the continued escalation of the Iranian nuclear program," adding that "Iran's production of highly enriched uranium has no credible civilian justification."

The statement came two days after the IAEA released a report saying Iran "increased its production of highly enriched uranium, reversing a previous output reduction from mid-2023....

The Western countries warned of "significant proliferation risks" in their statement released on Thursday, stating that "these developments constitute a step in a bad direction on the part of Iran." The allies, however, stated they were "committed to a diplomatic solution" to the conflict over Tehran's nuclear program and urged for the reversal of the output increase without mentioning any potential repercussions for Iran.

By the IAEA's theoretical definition, Tehran already possesses enough uranium of 60% quality, if enriched to 90%, to construct three nuclear bombs. Iran has said it does not want nuclear weapons. The 2015 agreement aimed at stopping Iran from obtaining nuclear weapons still includes participation from Britain, France, and Germany. In 2018, former US President Trump broke the agreement, which led Iran to gradually loosen its restrictions.

Source: <https://www.bolnews.com/international/>

2023/12/iran-defends-higher-uranium-enrichment-calls-it-peaceful-despite-western-concerns/, 30 December 2023.

Iran Calls for IAEA Impartiality in Resolving Safeguard Issue

Mohsen Naziri Asl said the Iran "always emphasizes that it will continue its cooperation with the agency within the framework of the Comprehensive Safeguards Agreement". The safeguard claims over Iran's nuclear activities are rooted in the fake documents of the Zionist regime to raise the alarm over the country's peaceful nuclear program.

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Amid the US withdrawal from the nuclear agreement in 2018, Israeli PM Netanyahu claimed to have discovered nuclear particles in undeclared sites across Iran. While rejecting the claims, Iran has always emphasized that countries' obligations under the Safeguards Agreement are not unlimited.... Despite

propaganda, the Islamic Republic has an "exemplary cooperation" with the IAEA. Just in November, an average 12 inspectors have been doing their work in Iran, which is a record among countries that implement comprehensive safeguards agreements, the Iranian envoy said.

Elsewhere in his interview, Naziri spoke about a recent meeting of the IAEA Board of Governors that discussed nuclear threats posed by the Israeli regime. He said that the environment of the meeting was against the regime and a total of 51 anti-Israel statements were proposed, which was unprecedented. Following the meeting, Grossi said in a post on X social media platform, formally known as Twitter, that his meeting with Eslami was "important." He added that the IAEA is willing to "engage and make concrete progress" in accordance with an agreement signed in Tehran in early March "to provide credible assurances that Iran's nuclear program is exclusively peaceful". The meeting came as tensions

between Tehran and the IAEA have been rising after Iran's move to bar a number of the nuclear watchdog's inspectors from being assigned to the country. Grossi had criticized Tehran for effectively barring several of its most experienced inspectors monitoring Iran's nuclear program.

Source: <https://www.farsnews.ir/en/news/14021004000444/Iran's-Envy-IAEA-Shld-Be-Imperial-in-Resolving-Safeguard-Isses>, 26 December 2023.

NORTH KOREA

North Korea will Seek to Increase Nuclear Weapons to Improve 'Second-Strike Capability'

North Korea will continue to escalate its nuclear threats against the US and South Korea next year while seeking to improve its capabilities to strike back with a nuclear weapon if it comes under a nuclear attack, experts said. Jun Bong-geun, a professor emeritus at the state-run Korea National Diplomatic Academy (KNDA), made the point at a briefing on the prospects of international relations for next year, stressing that North Korea has taken the "most aggressive nuclear posture in the world" due to its inadequate "second-strike" capability.

However, North Korea, with a limited arsenal of only around 50 nuclear weapons, is unlikely to have the capability to launch a nuclear retaliatory attack after sustaining a "first strike" from an adversary, he added. Choi Woo-seon, a professor at the KNDA, echoed Jun's views, saying North Korea can carry out a provocation any time next year, though it will likely be "limited" under the US extended deterrence,

Yonhap news agency reported.

On growing military cooperation between Russia and North Korea, Jun saw it unlikely for Moscow to transfer arms related to intercontinental ballistic missiles. In October, the US government said the North Korea had shipped more than 1,000 containers of military equipment and munitions to Russia. The revelation came after North Korean leader Kim Jong-un and Russian President

Putin met at the Vostochny Cosmodrome, a Russian spaceport, in September, raising concerns about a possible arms deal between the two countries.

Source: <https://indiatribune.com/n-korea-will-seek-to-increase-nuclear-weapons-to-improve-second-strike-capability-experts/>, 27 December 2023.

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NUCLEAR SAFETY

CAMBODIA

IAEA Mission to Assess Cambodia's Nuclear Security for Material Out of Regulatory Control

The IAEA completed an advisory service mission to Cambodia focused on assessing the country's nuclear security regime for nuclear and other radioactive material out of regulatory control (MORC). The team said the country has implemented measures to detect and respond to criminal or intentional

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The mission, carried out at the request of the Royal Government of Cambodia, took place from 11 to 22 December and involved a team of nine international experts from Finland, Hungary, Japan, Morocco, Pakistan, the United States of America, Vietnam and the IAEA. It is the second mission of this kind to Cambodia. ... The draft findings and recommendations were presented to the Royal Government of Cambodia, and the final report will be presented in about three months.

Source: <https://www.devdiscourse.com/article/technology/2757028-iaea-mission-to-assess-cambodias-nuclear-security-for-material-out-of-regulatory-control>, 26 December 2023.

INDIA-PAKISTAN

India, Pakistan Exchange List of Nuclear Installations Amid Frosty Ties

India and Pakistan on 1 January 2024 exchanged a list of their nuclear installations under a bilateral pact that prohibits the two sides from attacking each other's atomic facilities, continuing an annual practice that began in 1992. The exchange of the list took place under the provisions of an agreement on the prohibition of attack against nuclear installations and facilities, the ministry of external affairs said.

The exchange of the list came amid frosty ties between the two countries over the Kashmir issue as well as cross-border terrorism. "India and Pakistan today exchanged, through diplomatic channels simultaneously at New Delhi and Islamabad, the list of nuclear installations and facilities, covered under the Agreement on the prohibition of attack against nuclear installations and facilities between India and Pakistan," the MEA said. The agreement was signed on

December 31, 1988 and came into force on January 27, 1991.

The pact mandates the two countries to inform each other of nuclear installations and facilities to be covered under the agreement on the first of January of every calendar year. "This is the 33rd

consecutive exchange of such lists between the two countries, the first one having taken place on January 1, 1992," the MEA said in a statement. The ties between India and Pakistan came under severe strain after India's warplanes pounded a Jaish-

e-Mohammed terrorist training camp in Balakot in Pakistan in February 2019 in response to the Pulwama terror attack.

Source: <https://m.rediff.com/news/report/india-pakistan-exchange-list-of-nuclear-installations-amid-frosty-ties/20240101.htm>, 01 January 2024.

JAPAN

Japan Earthquake Casts Cloud Over Push to Restart Nuclear Plants

The powerful earthquake that hit Japan's western coast on New Year's Day has underscored the country's exposure to natural disasters, casting fresh doubt over a push to bring its nuclear capacity back online. Nuclear power plants dot the coast of

mountainous Japan, which is prone to earthquakes and tsunamis due to its location on the seismically active "Ring of Fire" around the Pacific Ocean.

Monday's magnitude 7.6 earthquake, which has killed more than 80 people in the Hokuriku region, destroyed infrastructure and left homes without power, struck days after regulators lifted an operational ban on Tokyo Electric's (9501.T) Kashiwazaki-Kariwa nuclear power plant. Tepco hopes to gain local permission to restart the plant, which is around 120 kilometres from the quake's

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epicentre and has been offline since 2012. The utility was banned in 2021 from operating the plant due to safety breaches including a failure to protect nuclear materials.

Monday's tsunami warning reminded him of the Fukushima disaster, he said. Tepco shares fell as much as 8% on Thursday, the first trading day since the earthquake, before closing up 2.2%. Hokuriku Electric (9505.T), whose idled Shika plant is located around 65 kilometres from the earthquake's epicentre, slid as much as 8% before paring losses to end down 2.2%. The company, which reported water spill-over from spent nuclear fuel pools and oil leaks at the plant after the quake, hopes to restart the No.2 reactor there sometime after April 2026, it said in October....

Source: <https://www.reuters.com/world/asia-pacific/japan-earthquake-casts-cloud-over-push-restart-nuclear-plants-2024-01-04/>, 05 January 2024.

NORWAY

Norway Joins the IAEA's Member State Support Programme for Nuclear Verification

Norway is the latest IAEA Member State to team up with the Agency's Department of Safeguards by establishing a Member State Support Programme (MSSP). The partnership, formally signed on 27 September 2023, will see Norway working closely with the IAEA to address challenges and opportunities in the field of nuclear safeguards.

"By establishing a MSSP, Norway intends to help the IAEA strengthen the Agency's nuclear verification system," said Per Strand, Director General of the Norwegian Radiation and Nuclear Safety Authority. "Norway has a long association with the IAEA and was the very first country to have an IAEA safeguards inspection in 1962. I'm

delighted that the new MSSP with the IAEA bolsters this long relationship."

MSSPs extend support to the IAEA in various forms, including knowledge exchange, technology transfer, expert collaboration and financial support. The establishment of Norway's MSSP marks a significant addition to the network of

active support programmes across the world, which has now reached 24. This partnership will allow the IAEA to work closely with Norway on a range of projects including advancing safeguards by design for new or modified facilities; training of IAEA safeguards inspectors; and developing and testing new spent fuel measurement methods.

Source: <https://www.iaea.org/newscenter/news/norway-joins-the-iaeas-member-state-support-programme-for-nuclear-verification>, 02 January 2024.

USA

South Carolina Nuclear Plant's Cracked Pipes Get Downgraded Warning from Officials

Federal regulators have lessened the severity of their warning about cracks discovered in a backup emergency fuel line at a South Carolina nuclear plant northwest of the state capital. The U.S. Nuclear Regulatory Commission downgraded its preliminary "yellow" warning for V.C. Summer Nuclear Station issued this October to a final "white" one after owner and operator Dominion Energy showed its generator could still run for six hours in an emergency, the agency announced Thursday. That demonstration calmed officials' concerns that Dominion Energy's failure to maintain cracks and leaks — discovered at least five times over the past two decades — had neutralized the plant's ability to cool down its reactors if electricity failed....

Officials plan to complete another inspection to see if Dominion Energy fixes the ongoing issues.

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In a statement to The Associated Press on Friday, the company said it immediately replaced the piping and will install “more resilient piping” early next year. Dominion Energy said the station only needs one power source for safe maintenance, and that the emergency diesel generators are only necessary if two offsite power supplies are unavailable. The company added that the November 2022 fuel oil leak marked the first time in 40 years that such a problem had put an emergency diesel generator out of operation.

“Dominion Energy’s commitment to safety, along with the NRC’s process for regulating nuclear power stations, ensure we continue to operate to the highest safety standards,” the company said in the statement. “We thank the NRC for considering additional information we provided, which resulted in categorizing the initial issue as low-to-moderate significance.”

Still, The State Newspaper reported that a leader at a watchdog group said the length of the problem warranted the more serious finding. The risk is that fires could break out, according to Edwin Lyman, the director of nuclear power safety at the Union of Concerned Scientists. The changes from Dominion Energy seem to be “pencil-sharpening exercises that make a bad situation look better on paper,” Lyman told The State.

Source: <https://abcnews.go.com/US/wireStory/south-carolina-nuclear-plants-cracked-pipes-downgraded-warning-105988939>, 29 December 2023.

NUCLEAR WASTE MANAGEMENT

BELGIUM

IAEA Sees Belgian Commitment to Waste Management

Belgium has a robust national infrastructure for the management of radioactive waste and used

fuel, an IAEA mission has said, and recommended the development of consolidated policies for specific waste streams and for decision-making on a geological repository. Belgium manages high-level waste from its five operating nuclear reactors at the Doel and Tihange plants as well as from the two reactors which have been permanently shut down, along with low- and intermediate-level radioactive waste from the production and use of radiation sources in medical, industrial and science and research activities.

The Belgian National Agency for Radioactive Waste and Enriched Fissile Material management (Ondraf/Niras) manages radioactive waste and

Belgium’s nuclear plants account for almost half of the country’s electricity production. The country’s federal law of 31 January 2003 required the phase-out of all nuclear electricity generation in the country. Under a plan announced by Belgium’s coalition government in December 2021, Doel 3 was shut down in September 2022, while Tihange 2 shut down at the end of January 2023.

used fuel after acceptance. The agency hosted the IAEA’s Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (Artemis) team during their ten-day visit in December....

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the country’s electricity production. The country’s federal law of 31 January 2003 required the phase-out of all nuclear electricity generation in the country. Under a plan announced by Belgium’s coalition government in December 2021, Doel 3 was shut down in September 2022, while Tihange 2 shut down at the end of January 2023. The newer Doel 4 and Tihange 3 would be shut down by 2025. However, a decision was subsequently taken to extend the operation of Doel 4 and Tihange 3, allowing for the retention of 2 GWe of nuclear generation capacity, with agreement reached between the Belgian government and French utility Engie last month on the terms of extending the two units’ operation by 10 years and on all obligations related to radioactive waste.

Source: <https://www.world-nuclear-news.org/Articles/IAEA-sees-Belgian-commitment-to-waste-management>, 08 January 2024.

CANADA**CNL Permitted to Build Chalk River Repository**

The Canadian nuclear regulator has amended the licence held by Canadian Nuclear Laboratories (CNL) for Chalk River Laboratories in Ontario, authorising the construction of a near-surface disposal facility for low-level radioactive waste at the site. CNL applied to the Canadian Nuclear Safety Commission (CNSC) in 2017 for an amendment to its nuclear research and test establishment operating licence for Chalk River Laboratories, to permit the construction of the Near Surface Disposal Facility (NSDF).

The proposed NSDF Project is intended to provide safe disposal of up to 1 million cubic metres of solid low-level radioactive waste including legacy wastes from 65 years of operations at the Ontario site, waste from the remediation of contaminated lands, and debris from Chalk River infrastructure decommissioning activities.... The commission also concluded that the design of the NSDF Project is "robust, supported by a strong safety case, able to meet its required design life, and sufficient to withstand severe weather events, seismic activity, and the effects of climate change". The amended nuclear research and test establishment operating licence remains valid until 31 March 2028. It includes two new conditions that require CNL to implement licensing regulatory actions and EA regulatory commitments for the NSDF Project. The CNSC's decision applies only to the construction of the NSDF Project. CNL will be required to apply for a separate licence to operate the facility. The NSDF would have an expected operating life of at least 50 years.

The majority of the waste to be placed in the NSDF is currently in storage at the Chalk River Laboratories site or will be generated from environmental remediation, decommissioning, and operational activities at the site. About 10% of the waste volume will come from other Atomic Energy of Canada Limited-owned sites or from commercial sources such as Canadian hospitals and universities.

Source: <https://www.world-nuclear-news.org/Articles/CNL-permitted-to-build-Chalk-River-repository>, 10 January 2024.

UK**Cyberattackers Target Nuclear Waste Company via LinkedIn**

Last week, a group of hackers targeted Radioactive Waste Management (RWM), a UK government-owned company behind the country's multibillion-dollar Geological Disposal Facility (GDF) nuclear waste-storage project, using social engineering and LinkedIn. RWM merged last year with two other companies to create Nuclear Waste Services (NWS), which also administers the Low Level Waste Repository in Cumbria, UK. Corhyn Parr, NWS's chief executive, noted that the attackers have been capitalizing on the business changes stemming from that merger to try to dupe targets into falling for social engineering gambits, largely through LinkedIn. So far, though, none of the attempts have had any "material effect," he added.

The attackers, however, were denied through what a company spokesperson referred to as "multi-layered defenses." Hackers will use social media sites to create fake accounts, write false messages, and send malicious links, as well as gather information to improve their messaging, all in order to gain access to a company's system through phishing or malware.

According to LinkedIn itself, in order to avoid becoming the victim of these types of scams or social engineering attacks, users should avoid engaging with impersonal messages, any messages asking for personal or financial information, messages with noticeable grammar and spelling mistakes, and messages including offers that are overly generous or "too good to be true."

Source: <https://www.darkreading.com/ics-ot-security/cyberattackers-target-nuclear-waste-company-via-linkedin>, 03 January 2024.

USA**Geopolymers as an Immobilization Matrix for Radioactive Waste**

For nearly a century, geopolymers have been used for construction, ceramics, fireproofing and other industrial applications. One of their most promising applications, in radioactive waste

management, has drawn considerable attention in recent years, and the IAEA is now launching a Coordinated Research Project (CRP) to better understand the performance of geopolymers in this area and facilitate their deployment.

Geopolymers, also known as alkali-activated aluminosilicate cements or binders, help immobilize and stabilize radioactive waste, effectively reducing the potential for radionuclide migration or dispersion.... Recent studies indicate that the use of geopolymers for immobilizing radioactive waste offers a promising alternative to traditional cement binders, presenting potential benefits for specific waste streams.

Despite these promising developments, a gap exists in comparing the performance of geopolymers with traditional cement binders, which have well-established waste form performance protocols. To address this challenge, the IAEA's new CRP aims to facilitate the deployment of geopolymers to immobilize radioactive waste. The CRP aims to

further unlock the potential of geopolymers by establishing common protocols and experimental conditions to enable thorough, reliable and repeatable assessments of waste form performance when using geopolymers... .

With the launch of this new CRP, the IAEA aims to establish a standardized approach to geopolymer waste form testing and contribute to sustainable,

efficient and environmentally friendly solutions for managing radioactive waste, ultimately benefiting both current and future generations. Member States can broaden their knowledge on testing protocols for geopolymer matrices which can be used for future nuclear installation construction, shielding materials, disposal matrices for nuclear waste and repairing damaged cement of nuclear constructions.

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Source: <https://www.iaea.org/newscenter/news/new-crp-geopolymers-as-an-immobilization-matrix-for-radioactive-waste-t21029>, 29 December 2023.



Centre for Air Power Studies

The Centre for Air Power Studies (CAPS) is an independent, non-profit think tank that undertakes and promotes policy-related research, study and discussion on defence and military issues, trends and developments in air power and space for civil and military purposes, as also related issues of national security. The Centre is headed by Air Marshal Anil Chopra, PVSM AVSM VM VSM (Retd).

Centre for Air Power Studies

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